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CONTENTS

HYPERPARATHYROIDISM.
Joseph F. Borg, M.D., Saint Paul..... 65

THE PRESENT STATUS OF OUR KNOWLEDGE OF THE ADRENAL GLAND.
Max H. Hoffman, M.D., Saint Paul..... 66

THE CLINICAL APPLICATION OF THE OVARIAN FOLLICULAR HORMONE.
L. F. Hawkinson, M.D., Brainerd, Minnesota 69

SUPRARENAL CORTICAL HORMONE.
Edward C. Kendall, Rochester, Minnesota 71

A BASOPHILIC ADENOMA OF THE PITUITARY GLAND.
Henry L. Ulrich, M.D., Minneapolis..... 73

FRACTURES OF THE LOWER END OF THE RADIUS.
Charles A. Reed, M.D., Minneapolis..... 78

FRACTURES OF THE CARPAL NAVICULAR BONE.
Wallace H. Cole, M.D., and *George A. Williamson, M.D.*, Saint Paul..... 81

(Continued on page III)

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Volume 18 FEBRUARY, 1935 Number 2

HYPERPARATHYROIDISM*

JOSEPH F. BORG, M.D.

Saint Paul

AMONG the many advances of recent years in endocrinology none has been more worthy of recognition than the establishment of hyperparathyroidism as a definite clinical entity. The complete clinical cure of a condition heretofore markedly prolonged, extremely painful and hopelessly crippling, is indeed a triumph of the combined efforts of the clinician, the laboratory and the surgeon. As with many medical discoveries, this condition was early considered rare, but with increasing knowledge of its pathogenesis, and with increased diligence on the part of the profession, there has been a progressively increasing number of cases discovered, the surgical treatment of which has produced remarkable results.

Hyperparathyroidism is a disease caused by a hyperfunctioning adenoma of the parathyroid glands. This condition causes an increase in the amount of parathyroid hormone liberated into the blood stream, with a resulting characteristic alteration of calcium and phosphorus metabolism, and the typical clinical syndrome associated therewith. Normally the calcium level in the blood, under control of the parathyroid hormone, is held fairly constant at from 9 to 11 mgm. per 100 c.c. of serum associated with a blood phosphorus of 2.5 to 3.5 mgm. per 100 c.c. This is normally fairly constant on the average daily diet which contains from 0.5 to 1.0 gm. of calcium and results in the excretion of about 0.1 to 0.5 gm. calcium daily in the urine and 0.4 gm. daily in the feces. With an increased secretion of parathyroid hormone there is a lowered blood serum phosphorus, increased blood serum calcium, and a markedly increased excretion of both calcium and phosphorus, chiefly in the urine. This hypercalcemia is caused by the action of the increased parathormone on the bones, calcium being liberated, and eventually producing a clinical decalcification.

The disease is insidious in its onset, and produces a varied group of symptoms. The most common initial complaint is muscle weakness, due to a muscular hypotonia, usually most marked in the extremities and often associated with flatfoot, lassitude and constipation. Bone pain, a common symptom, is usually what brings the patient to the physician. This pain is usually marked in the bones of the legs, is associated with the decalcification and is often considered a neuritis or arthritis, resisting all treatment. As the disease progresses there is often a moderate weight loss, and moderate anemia, while the generalized decalcification progresses to a point of bone deformity. Bone cysts which may be easily palpated, and frequently pathological fractures, occur. A kyphosis may develop and the patient's stature may decrease. Unexplainable digestive complaints often arise, even simulating appendicitis, and there is frequently a polydypsia and polyuria associated with the efforts of the kidney to eliminate the excess calcium. Under these circumstances renal stone is a not infrequent complication and in at least seven reported cases was the source of the only complaint.

The appearance of any one or a combination of the foregoing symptoms should suggest the possibility of hyperparathyroidism, and x-ray of the bones, blood calcium studies and twenty-four hour urinary calcium excretions, should be made. While in but rare exceptions the blood calcium

*Presented in Symposium on Endocrinology at the annual meeting of the Minnesota State Medical Association, Duluth, July 17, 1934.

will be increased and the blood phosphorus decreased, a careful study of the twenty-four hour urine calcium will always show an increased excretion. The roentgenogram in early cases will show a diffuse ground glass appearance of the bones, a generalized decalcification throughout the skeleton. Later the formation of cysts and the redeposition of new bone produces the typical picture of osteitis fibrosa cystica, by which name this condition has previously been known. As far as known, hyperparathyroidism is always due to a benign adenoma of the parathyroid gland, which may vary in size from a bean to an egg, and is sometimes cystic. The tumor may be located behind any pole of the thyroid gland or it may be aberrant and hard to find. It may be located in any part of the neck, or in the mediastinum, and where the clinical diagnosis has been established, the responsibility is on the surgeon, who must persistently explore for the tumor. The removal of normal parathyroids has failed to produce recovery.

In conclusion, then, the medical profession is presented for its consideration a well established clinical picture of oversecretion of the parathyroid hormone, a long standing, seriously disabling, disease. It is not difficult to diagnose, and the neglect of consideration of it is serious, especially so when satisfactory treatment is available. It must be remembered that all of the symptoms mentioned need not occur in any one case, but that the occurrence of any, or particularly a combination, should lead to an investigation of the calcium metabolism. The laboratory is indispensable in establishing the diagnosis in this condition, as numerous other conditions may simulate the clinical picture which it presents, but no other known disease presents its characteristic alterations in the blood calcium level and urinary calcium output. The determination of these is not difficult and should be provided by every well trained experienced laboratory technician. When seventeen cases could be reported from a single hospital in a period of two years, the condition cannot be regarded as uncommon. When seven of these cases were discovered by routine blood calcium studies on all the cases of renal stone admitted to this hospital, the importance of the consideration of hyperparathyroidism in this condition is emphasized.

Therefore, every patient exhibiting lassitude, muscular weakness, recent flat-foot, persistent extremity pains, bone deformity, pathological fracture, polyuria or signs of renal stone, otherwise unexplained, should have the advantage of a study of calcium metabolism. Such consideration is not too much to give when it will undoubtedly result in the recognition of hyperparathyroidism as the cause of some puzzling clinical problems.

THE PRESENT STATUS OF OUR KNOWLEDGE OF THE ADRENAL GLAND*

MAX H. HOFFMAN, M.D.

Saint Paul

ALTHOUGH recent contributions to our knowledge of the adrenal gland has added to our fund of information, the mechanism underlying its activity is still a mystery. We know that it is intimately concerned with certain metabolic functions, with growth and sex changes, but we lack a definite knowledge of the exact manner of this action. This deficiency in our knowledge is not the result of investigative inactivity. During 1933 about 600 reports were published dealing with some phase of adrenal gland disease or physiology.

The gland consists of two portions, embryologically derived from different anlage. The cortex develops from the wolffian bodies from which the genital structures originate, and the medulla comes from the same anlage as the sympathetic nervous system. This explains somewhat the relationship between the adrenal cortex and sex differentiation and between the medulla and certain nervous phenomena related to it.

As far as we know today the entire function of the medulla is concerned with the secretion and storage of epinephrin. It acts to aid the individual to run or fight, and the "emergency theory" of Cannon has been quite generally accepted. The

*Presented in Symposium on Endocrinology at the annual meeting of the Minnesota State Medical Association, Duluth, July 17, 1934.

medullary portion of the adrenal gland is not necessary for the maintenance of life. Certainly, except in emergency periods, very little if any epinephrin is excreted into the blood stream. There is a small amount of evidence to show that epinephrin is formed in the cortex and stored in the medulla, but this evidence is not at all convincing.

Of much more importance is the adrenal cortex. This part of the gland is essential to life, and its destruction or removal leads to death in an experimental animal in about ten days. Following complete adrenalectomy, several things happen. The animal loses its appetite and becomes very weak. It loses weight rapidly. Circulatory failure sets in and later convulsions and death. Along with these general symptoms there is a marked decrease in blood sugar, and in the liver and muscle glycogen. On account of the loss of fluids the blood concentration increases. The calcium phosphorus and non-protein nitrogen of the blood increases. Before death the animal presents a picture of hypoglycemia or shock, indicating that death was due to a severe metabolic or circulatory disturbance.

Three theories of adrenal cortical function have been advanced and are based on studies after adrenalectomy and with the aid of the adreno-cortical hormone. Britten and Silvette[2, 3, 4, 5] have pointed out the similarity between the symptoms presented by adrenalectomized animals and those with hypoglycemic shock. They believe that death following adrenalectomy results from marked changes in the carbohydrate metabolism. When adreno-cortical hormone is administered to these animals, the normal carbohydrate levels are promptly restored. The proponents of the theory realize it does not explain all the disturbances that occur after adrenalectomy, but they believe the basic change is in the carbohydrate metabolism.

Hartman and his co-workers sponsor the idea that the adrenal gland produces a hormone that acts on all the cells of the body—that it is a general cellular hormone. Although this theory is rather vague, the number of the various tissues involved, following adrenalectomy, lend to it some support.

A third theory advanced by Swingle[5] is to the effect that the function of the adrenal cortex is to "regulate and maintain the normal circulatory volume in the vascular system. That in the adrenalectomized animals, fluid is being continually lost in the circulation, presumably by transudation through the capillary walls. The adrenalectomized animal is unable to maintain his normal blood volume, and eventually dies of circulatory collapse, due to an insufficiency of circulatory fluid." The decrease in blood volume produces a decrease in blood pressure and an increase in the blood viscosity, which results in the slowing of the circulation. Swingle compares the striking similarity of adrenal insufficiency with that of shock.

These three theories have been advanced by men whose contributions to our knowledge of the adrenal gland have been of the highest value. Each conception has the support of considerable experimental and clinical evidence, but no one alone seems to be satisfactory. The failure of the adreno-cortical hormone to clarify this subject has been most disappointing. The isolation of this extract by Swingle and Pfiffner and Hartman has been one of the real achievements of endocrinology. This hormone will promptly and completely relieve all the symptoms of experimental adrenal insufficiency, and keep adrenalectomized animals alive indefinitely. Unfortunately the scarcity of this hormone and the excessive cost in producing it has prevented its application in conditions where it might prove to be of value. Kendall has recently crystallized and partially chemically identified this hormone, which leads us to hope that in the near future this substance will be synthesized.

In clinical medicine the cortical-adrenal hormone has been used with remarkable success in Addison's disease. At times it has restored almost lifeless individuals in a very dramatic manner. However, it has also had its failures, due in some cases to an insufficient amount of hormone, and in others to the tuberculosis underlying the destruction of the glands. It has been tried in a very limited way in other conditions but with no success. So far we are able to recognize only one clinical condition associated with hypofunction of the adrenal, and that is Addison's disease. The other states referred to as hypoadrenia have not been definitely established.

Hyperfunctioning states of the adrenal gland have recently received considerable attention. They are associated mostly with tumor develop-

ment in the medulla or cortex. This type of overactivity is rather characteristic of all of the glands of internal secretion. Such tumor growths are found in hyperparathyroidism, hyperinsulinism, and hyperactive conditions of the pituitary and thyroid glands.

In the adrenals these tumors are capable of bringing about two types of changes, one concerned with pseudohermaphroditism in early life and a reversal of the secondary sex characteristics in the adult, and the other evidences itself most prominently in hypertensive conditions. The exact relationship between the adrenal and the sex glands is not clear. Several observers working with the cortical-adrenal hormone claim that it has a definite effect on the sex characters; others fail to confirm this finding. This discrepancy is possibly due to the presence of a sex hormone, separate and independent from cortin, and the failure of these investigators to achieve the same results might be due to one using a preparation that contains both hormones, and the other one that contains only cortin. No adrenal sex hormone has been definitely isolated. Clinically the effect of adrenal activity on sex is most often seen in the female as a reversal of the normal sex characteristics. Hirsutism, overdevelopment of the clitoris, amenorrhea, and voice changes are the most prominent. Along with these, hypertension and obesity may be present. In the male adult with an adrenal tumor, virilism or effeminization may appear.

It is a question as to whether all pseudohermaphroditism is a result of adrenal overactivity. It is conceivable that same cases may arise in which the failure of complete sex differentiation is due to chromosomal influences. Bauer[6] believes that the adrenal hormone is capable of stimulating to development the latent sex characters of the opposite sex which are normally present, and at the same time it inhibits the effect of the hormone of the sex gland. The sex reversal process can also take place with a hyperplasia of the cortex of the gland in the absence of a tumor. This condition does occur in the syndrome described by Cushing as basophilism, where presumably the basophilic cells of the anterior pituitary lobe secrete an adrenotropic hormone. The clinical picture of obesity, hypertension, plethora and sexual disturbances is common to both conditions.

The other type of adrenal tumor is associated with hypertension. A number of such cases are now on record that are definitely associated with adrenal growths. The tumor may be cortical or medullary or involve both portions. It may also develop in paraganglionic tissues. With the latter has been associated the paroxysmal type of hypertension described by Mayo and others.

Successful removal of these tumors has been accomplished in several instances, and one such tumor was found to contain a large amount of adrenalin. On the basis of the above observations regarding the relationship between adrenal overactivity and hypertension, operation on the glands has been attempted. Partial resection of the glands, denervation, and sympathetic ganglionectomy have been tried wtih some good results. Crile has practiced denervation of the glands in other conditions, such as hyperthyroidism and neurocirculatory asthenia. He describes the adrenals as being "the brain or the powerhouse of the sympathetic nervous system." The entire subject is much too recent to have developed beyond the experimental stage. Its progress will be watched with great interest, as it offers therapeutic possibilities in conditions where we now can do very little. Rowntree[7] calls our attention to the necessity for more clinical investigation in the field of adrenal diseases, as he feels it has been very much neglected.

Marine[6] and others have brought out some evidence that the adrenal may be concerned with resistance against toxins and infections. Animals deprived of their suprarenal glands are definitely less resistant to morphine and histamine, this sensitiveness being reduced by injecting adrenal cortical hormone. These animals have been shown also to be less resistant to bacterial infections.

Modern endocrinology is still in its infancy, and as our knowledge increases we realize more and more that the endocrine glands form a system in which each gland acts to inhibit or stimulate the other. The adrenal gland is not the least important in this group. This short review of the present status of our knowledge of this gland has pointed out its incompleteness; at the same time we cannot fail to be impressed with the rapid advances that are being made which may offer much to the clinician of the future.

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THE CLINICAL APPLICATION OF THE OVARIAN FOLLICULAR HORMONE*

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THE follicular or estrus-inducing hormone of the ovary is commonly called estrin. It is obtained commercially from the urine of pregnant women, the amniotic fluid of cattle and from the human placenta. This hormone is also known as folliculin, amniotin, progynon, theelin, sistomensin and various other trade names. It is available in both oral and hypodermic forms, both of which are potent. The ratio of the oral to the hypodermic dosage is about four to one.

The hormone has been used in practically all the ills of the human female. In some conditions it has proven of value; in others the misuse of the hormone, especially in large doses, has probably caused some harm.

There are several conditions in which estrin is now felt to be specific. These conditions are: amenorrhea with hypoplasia, functional dysmenorrhea, gonorrheal vaginitis in children, and menopausal disturbances.

Amenorrhea with Hypoplasia

Though the amenorrhea may be due primarily to a deficiency of the pituitary hormone, estrin is first used to vascularize and increase the size of the uterus, thereby making it more responsive to pituitary therapy.

The Frank and Goldberger test to determine the amount of hormone in the blood is of value but often difficult to obtain. The determination of the degree of uterine hypoplasia is of greater value and almost indispensable in these cases. This is accomplished by passing a graduated uterine sound, discounting the long cervix usually found. A measurement of less than seven centimeters calls for intensive treatment with the ovarian follicular hormone. The amount of hormone to be administered is directly proportional to the degree of hypoplasia and the administration should be continued until the uterus is of normal size. In cases where the hypoplasia is marked, one thousand rat units daily is usually required for several months. When the hypoplasia is not marked, one hundred to two hundred rat units daily by mouth for several months is usually sufficient. The cost of the treatment in amenorrhea with hypoplasia is necessarily high.

Functional Dysmenorrhea

It is estimated that 15 to 20 per cent of virgins suffer from functional dysmenorrhea. Only one-third of these can be relieved by operative procedures but the percentage relieved by hormone therapy is estimated at 60 to 80 per cent.

The hormone is best given beginning the sixteenth day of the menstrual cycle. A great majority of patients are relieved by the oral administration of one hundred rat units twice daily for ten days. It is advisable and often necessary to continue treatment for three months. If results are not obtained with the smaller doses, larger doses should be given. The failure to

*From the Brainerd Clinic, Brainerd, Minn. Presented in Symposium on Endocrinology at the annual meeting of the Minnesota State Medical Association, Duluth, July 17, 1934.

obtain relief in this type of dysmenorrhea is usually due to insufficient dosage.

Gonorrheal Vaginitis in Children

Gonorrheal vaginitis in children responds to estrin therapy when all other types of therapy have failed. The object is to change the character of the vaginal mucosa without producing uterine bleeding. Fifty to one hundred rat units daily until the vaginal smears are free from gonococcus is the suggested dosage. This type of therapy is not applicable to gonorrheal vaginitis in the mature woman.

Menopause

The major symptoms of natural menopause are due to a gradual decline in ovarian function and substitution therapy with the ovarian follicular hormone is rational and productive of good results in the majority of cases. The hormone is most effective if given orally and it is rarely necessary to exceed forty rat units daily. Early failure or lack of results from small doses should not lead to abandonment of treatment but should call for persistent use of this dosage. Only those cases of natural menopause in which the hormone is excreted in the urine fail to respond to this type of treatment. It is estimated that this group comprises less than 10 per cent of cases. The cost of treatment to the patient is about ten cents per day.

Surgical menopause requires the same type of treatment but the dosage should be somewhat higher. One hundred rat units daily usually controls the symptoms and this may be decreased as the symptoms subside. The hormone should be given as early following castration as possible.

There are several other conditions in which estrin has been used with considerable degrees of success. The hormone may not be specific in these conditions but it is certainly worthy of further trial.

Hyperemesis gravidarum often responds favorably to estrin therapy. Twenty-five to fifty rat units, intramuscularly, once to twice daily often controls this type of vomiting.

Painful breasts associated with menstrual disturbances are often due to inadequate amounts of the follicular hormone and many cases are relieved by the oral administration of two hundred rat units daily for five days preceding the menstrual period.

Migraine, frigidity, post-menopausal pruritus vulvæ, menopausal arthritis, menopausal epilepsy, involutional psychosis and senile vaginitis have been treated with the follicular hormone with varying degrees of success. It is probable that the hormone will be found to be of distinct aid in some of these conditions but it is not to be considered a panacea for all of them. More careful selection of cases, more accurate diagnosis, and more efficient test for the hormone in the blood and urine will be of distinct aid in determining the use of the hormone in these conditions.

The ovarian follicular hormone has been used experimentally in seven cases of hypochromic anemia. The fact that this condition is peculiar to women and is often associated with menstrual disturbances would lead one to believe that the condition may be endocrine in etiology. The results obtained in this small series of cases have been encouraging.

Clinical observations over the past four years would seem to indicate that at least one type of chronic nervous exhaustion is due to a deficiency of the ovarian follicular hormone, estrin. A preliminary report of these observations may be of interest.

Chronic nervous exhaustion is a term not well defined and is synonymous in the minds of many with neurasthenia. Chronic nervous exhaustion may be divided into several types and the type under discussion seems to be common in women and peculiar to that sex.

A short description of the syndrome will aid in its identification.

These patients complain of being tired all of the time. They awaken in the morning as tired as they went to bed. Exhaustion after exertion is often extreme. Nervousness, irritability and emotional instability are usually present. They worry over trivial matters, cry easily and are critical of their environment. Palpitation, gastric disturbances, choking spells, aches and pains in various parts of the body are often additional symptoms. The history frequently suggests a mild hyperthyroidism but the metabolic rate is usually normal or somewhat depressed. Amenorrhea, scanty menstruation and dysmenorrhea are frequent, though the syndrome is not uncommon in the absence of menstrual disturbances. Frigidity is common. There is seldom organic disease to account for the symptoms.

The condition is more frequent after repeated pregnancies, miscarriages or following the removal of an ovary or an ovarian cyst, damage to the blood supply of the ovaries, or follicle cystosis. It is well established that a hypofunction of the ovaries may exist at any time from puberty to menopause.

The symptoms of menopause or castration, due to decline or a deficiency of the follicular hormone, are similar in many respects to the symptoms of this type of chronic nervous exhaustion. The follicular hormone of the ovary allays the hyperexcitability of the autonomic nervous system incident to menopause. It is logical to assume that this hormone will have the same effect at any time from puberty to menopause.

The series consists of over one hundred cases. Controls have been used consisting of substituting other preparations for the hormone and discontinuing treatment for a period of time. Return of symptoms was the rule following these procedures.

The dosage used in the treatment of these cases usually has been low. Fifty rat units by mouth has been sufficient in the majority of cases. It is rarely necessary to exceed one hundred rat units daily. The results have been excellent in about 75 per cent of cases. The majority have been able to discontinue the hormone after two to three months, though in ten cases it has been necessary to continue the hormone indefinitely. Pituitary therapy has been used in conjunction with the estrin in fourteen cases.

The oral administration of the ovarian follicular hormone is preferable in all cases not requiring large doses. The hypodermic method necessitates frequent visits to the physician and it has been proven that large doses of the aqueous preparations, given by the hypodermic method, are not adequately absorbed. The newer preparations of the hormone in oil, in which the period of absorption is six to ten days, seem to offer a marked advantage where large doses of the hormone are required.

Recent results obtained with the hormone in oil (Progynon B, 2,000 and 10,000 R.U.) would indicate that the doses generally used and herein recommended are inadequate in many cases. It is probable that in the future we will speak in the terms of thousands of rat units, rather than in hundreds.

SUPRARENAL CORTICAL HORMONE*

EDWARD C. KENDALL

Rochester, Minnesota

THE isolation in pure crystalline form of the hormone of the suprarenal cortex was reported about three months ago.[3] Its chemical and physical properties have been determined and an investigation concerning the chemical structure of the molecule is far advanced.

The isolation of a single substance in pure crystalline form closes one chapter of the investigation. The most important question at the present time is whether or not the crystals which have been separated are in fact the hormone of the suprarenal cortex. Before attempting to answer this question I shall review briefly some of the quantitative results which we have obtained in regard to the distribution of this compound. In confirmation of the results of other workers, we have found that only a small amount of the hormone of the suprarenal cortex, cortin, is present in the gland.[1] We have recently found that the amount is equal to approximately 1 per cent of the epinephrine in the same weight of gland. The amount of epinephrine present averages somewhat less than 0.2 per cent of the wet weight of the gland. Thus, less than 0.002 per cent of the wet weight of the gland is cortin. The amount of cortin in both glands of a beef is about 0.5 mg. and the weight of cortin in a single gland is therefore approximately 0.25 mg. These values emphasize the fact that the commercial preparation of cortin is surrounded by problems which do not have to be met in the treatment of some of the other ductless glands. In the case of the thyroid gland, the simple desiccation and removal of the fat is the only treatment necessary for the satisfactory prepara-

*From the Section in Chemistry, The Mayo Foundation, Rochester, Minnesota. Presented in Symposium on Endocrinology at the annual meeting of the Minnesota State Medical Association, Duluth, July 17, 1934.

tion of an active form of thyroxine. With the parathyroid, the gland may be given a drastic treatment with hot mineral acid without destruction of the active agent. Special problems are encountered in the preparation of insulin because of the presence of enzymes which can bring about its destruction, but all of these problems have been satisfactorily solved and insulin can be prepared and placed on the market at a reasonable price. In the near future, cortin will be available at a price which will be within the reach of most patients, but certain limitations apparently will restrict the production of cortin and always will make this compound a relatively expensive one.

Under these conditions it seems desirable to carry out an exhaustive chemical study of the suprarenal cortex, not only so that cortin may be prepared as cheaply as possible from the gland but so that we may gain an insight into the chemical structure of the molecule. A knowledge of the structure of cortin is desirable for two reasons: (1) so that we may relate its activity to physiologic processes and to other active agents in the body, and (2) there is always the hope that cortin may be prepared synthetically at a price which will make it available to all.

The investigation of the chemical structure of any compound must be preceded by the isolation in pure crystalline form of the compound in question. It therefore becomes a matter of great interest to determine whether or not the crystalline compound isolated can bring about a physiologic effect which is identical with that produced by extracts prepared from the suprarenal gland.

Hartman and Swingle and Pfiffner were the first to show that an extract can be prepared from the suprarenal cortex which will maintain animals in normal condition after complete removal of the suprarenal glands. Several methods have been proposed for the preparation of cortin from the suprarenal gland. We have prepared large amounts of cortin by a method which need not be given at this time. After complete suprarenalectomy we have found that dogs can be maintained in normal condition in respect to body weight and all other criteria which can be applied. The daily requirement for each animal can be determined by administration of the solution. In each case a certain minimal amount must be given in order to maintain the animal.

If to such an animal cortin in crystalline form is administered in place of the extract from the gland there is no loss in weight or other change; the animal remains in normal condition. If then the administration of crystalline cortin is stopped, the animal very promptly develops symptoms of suprarenal insufficiency. One dog that was treated in this way died on the third day after administration of crystalline cortin had been stopped.

A patient who had a severe case of Addison's disease was maintained for eighteen days by administration of about 10 mg. of crystalline cortin each day, without development of signs of insufficiency. Finally, a dog which was suprarenalectomized by Doctor Mann was given the crystalline hormone during the eight days following operation. The dog received no other form of medication and survived the operation. It appeared to be normal at the end of eight days and was placed on a high salt diet. The dog is still living.

With these results we feel satisfied that the essential physiologic activity which can be demonstrated in the solutions made from the suprarenal cortex is also produced by the substance which has been separated in pure crystalline form.

We have furthermore found that the cortin in crystalline form is quite insoluble in water; 1 part will dissolve in about 10,000 parts of water. There is present in the solution, however, a more soluble form of the hormone which will exert the same physiologic effect, and, insofar as can be determined, the weight of material in soluble form is the same as the weight required in crystalline form. The exact relation between the two forms has not yet been established but the essential groupings appear to be aldehyde and hydroxyl groups. There is no change in molecular weight when the hormone assumes the less soluble form. The problem of the chemical nature of the suprarenal cortex has now been reduced to a concrete problem in organic chemistry. We may feel certain that in the near future the structure of the crystalline hormone will be established, and after this has been accomplished we shall be in a position to know whether or not this complex substance can be made synthetically.

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A BASOPHILIC ADENOMA OF THE PITUITARY GLAND*

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G. D., a married woman, twenty-seven years of age, first entered the hospital January 6, 1933. There were three admissions. The first January 6 to March 3, 1933, the second from June 2 to June 21, 1933, and the third November 11 to November 13, 1933, the date of her death. During July, August, September and October, she was observed in the out-patient department. Practically, this patient was under supervision some ten months.

Her complaint on entrance was: weakness, headaches, painful abdomen (particularly on the left side), polyuria, polydipsia, polyphagia. She was also suffering from boils about the thighs and gluteal region.

The family history is not very illuminating. Her father is a large man, six feet two inches tall and weighing 212 pounds. He has hypertension. Her mother died of an accident at thirty-five. No details of her appearance were given. One brother is tall, thin and very nervous. One sister, aged thirty, is short and fat, and has had two normal children. One sister is twenty-four and is tall and stout. Both sisters have normal menstruation.

The personal history reads as follows: Up to seven years of age she was puny, underweight and suffered from asthma. The asthma disappeared at seven and a period of good health supervened until sixteen, at which time she weighed 160 pounds. Her menses began at sixteen, but were scant and painful. At nineteen she married. She has never been pregnant. At twenty-five her weight had reached 220 to 230 pounds. At twenty-four she noticed her first crop of boils. At twenty-six hypertrichosis and amenorrhea appeared, likewise the symptoms of diabetes, that is, polydipsia, polyphagia and polyuria; also weakness, frontal headaches, abdominal pains. A few months before entrance she had lost fifty pounds. There had been an emotional upset and the patient starved herself.

Her physical examination (a composite picture is detailed of numerous examinations in which there was little variation) showed a woman of small stature with a remarkable appearance. Her face, which was full, had a plethoric hue with a growth of hair on the sides, resembling the Burnside type of whiskers. There was fairly long hair on her upper lip and under the chin. Her extremities were small in comparison with her body. There were deposits of fat over the shoulders; the breasts were large and pendulous. The abdomen was very obese. There were striæ over the abdomen of a purplish hue. The lungs were clear. The heart was rapid, regular, somewhat enlarged to the left. Blood pressure was 178 systolic and 122 diastolic. The abdomen was so fat that palpation was worthless. There were old scars and pigmented areas of previous skin infections over the buttocks and thighs. The pelvic examination by the gynecological staff detailed external genitalia normal; the vagina nulliparous; uterus one-half the normal size; adnexa negative. Impression: Pubescent genitalia.

X-ray of the gastro-intestinal and genito-urinary tracts revealed nothing except a large left kidney. A retrograde pyelogram on this side showed a normal pelvis. X-ray of the skull showed some osteoporosis of the calvarium; sella slightly, if any, enlarged; posterior clinoid process showed some erosion. X-ray of the spine and pelvic bones showed normal structure, possibly some osteoporosis. X-ray of the heart elicited a slight enlargement to the left.

Laboratory studies: Urine showed large amounts of sugar; no other abnormalities were observed. At no time during the ten months was she sugar-free. Her blood pictures were normal, with a tendency toward high values. The hemoglobin ranged from 88 to 100 per cent, reds 4,650,000 to 5,410,000, white 7,800 to 8,850, with normal differentials. Platelets 205,580. Her last blood picture, during the acute terminal illness, read: hemoglobin 74 per cent, whites 9,800, reds 3,800,000, polymorphonuclears 80 per cent, lymphocytes 20 per cent. Blood chemistries were normal, except blood sugars, which were always high, ranging above 200 mgms. Sugar tolerance tests in January and June showed the characteristic diabetic curve. The blood calcium (three readings) was within normal limits. Bleeding and clotting times were normal. The basal

*Read before the Minnesota Pathological Society, January 16, 1934, and also presented in Symposium on Endocrinology at the annual meeting of the Minnesota State Medical Association, Duluth, July 17, 1934.

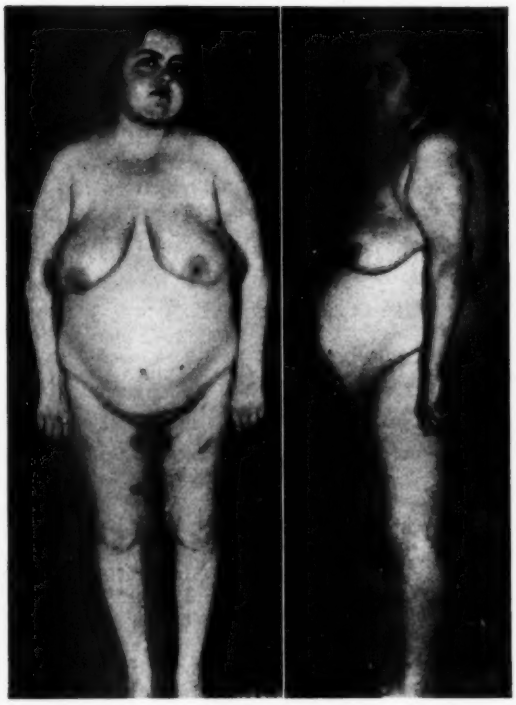

Fig. 1 *(left)*. Front view of patient showing the full face and the hirsuties of face. The plethora cannot be reproduced in the print. Also the disproportion of torso to extremities. The pigmented areas on thighs of previous skin infections can be seen.

Fig. 2 *(right)*. Lateral view showing the fat deposits on the body. The striæ are poorly visualized.

Fig. 3. Face of patient showing the beardlike growth.

metabolic rates were minus 4 per cent, minus 7 per cent and minus 11 per cent. The visual fields, by perimetric, nerve and retinal studies, were normal.

Her striking appearance immediately aroused a discussion as to the cause of her symptoms. Dr. Luther Fisher, Fellow in Medicine, was the first to suggest we were dealing with a basophilic adenoma of the pituitary. This opinion was concurred in by the Staff. The last week in February and early in March she received x-ray therapy of the sella and was discharged. During the interim she had had vigorous treatment for her diabetes, with improvement of her polydipsia, polyphagia and polyuria, but at no time was her urine sugar-free.

She returned in June for observation. Her symptoms of diabetes had been ameliorated. Her appearance and weight had not changed. The x-ray of the skull showed essentially the same findings as on previous examination. Her urine, blood picture and blood sugar levels were unchanged. Boils continued to appear. She was discharged to the Out-Patient Department. Here, she did not do so well.

During July, August, September and October her diabetic symptoms increased. The records in the Dispensary show her blood pressure 220/138. She had daily attacks of dizziness with fainting spells.

On November 11 she reappeared at the hospital. Following a pin prick in her left hand she developed a fulminating infection in her hand. The cellulitis extended up the forearm, with axillary breakdown. The axillary abscess was incised and she died November 13, 1933, of terminal bronchopneumonia.

The post-mortem report is as follows: (We are indebted to Dr. Richard Johnson for the permission and Dr. William O'Brien for reports of the section.)

1. Infection: Left arm and axilla. Death due to lobular pneumonia.
2. Hypertension: Heart weighed 475 grams. There is no sclerosis of the aorta and other vessels. Kidneys show mild evidence of hypertension.
3. Pineal: Shows normal limits of calcification.
4. Thyroid: Weight 24 grams. Histologically normal.
5. Parathyroids: Normal. Not hyperplastic.
6. Thymic body: 60 grams. Atrophic, fat.
7. Pancreas: Normal.
8. Adrenals: Right 10 grams, left 9.4 grams. Histologically normal. Slight atrophy of the medulla with infiltration of lymphocytes.

9. Ovaries: 7 grams. Senile.
10. Uterus: Small.
11. Breasts: Fat. Atrophic glands.
12. Pituitary: The pituitary is large, eroding the posterior clinoid. There is evidence of it bursting through the diaphragm. A tumor is found in the anterior lobe, crowding the pars intermediares and posterior lobe backwards and laterally. On section there is much calcium distributed throughout the tumor mass.

All other organs are normal.

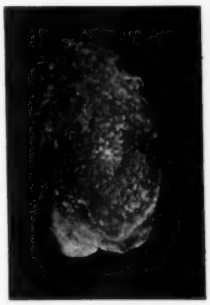

Fig. 4. Pituitary cut sagittally 1-1 showing the size of the new growth, its displacement of what is left of the anterior and posterior lobes. The stalk is also seen.

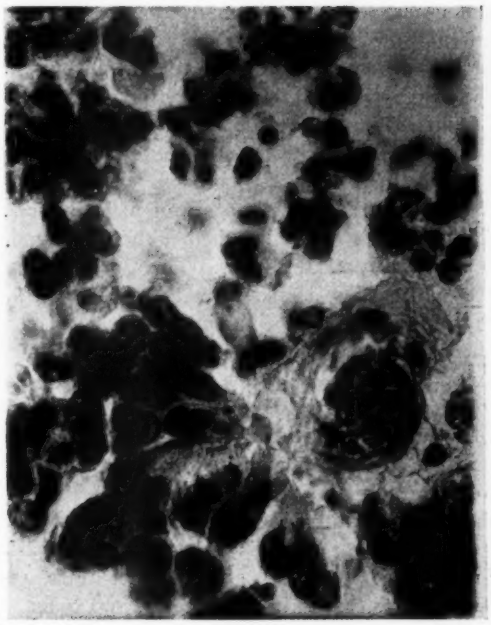

Fig. 5. Microscopic section 1-600 of tumor cells.

The essential finding in our case is obesity of a special type, with plethora, hypertrichosis, hypertension, amenorrhea, glycosuria and hyperglycemia, osteoporosis, skin lesions, with susceptibility to infection. This clinical picture is usually found in early adult life, and, with its variants, Cushing[2] hypothecates, is due to an adenoma of the pituitary and that this adenoma is basophilic in type. This adenoma, like the acidophilic adenoma, which gives us the picture of acromegaly, delivers a hypersecretion, which in turn disturbs the endocrine system to the extent of transforming a normal individual into a clinical picture such as we have described.

This same picture, with unessential variations, has been attributed to tumors, sometimes malignant, of the adrenal glands.

In the male, the same findings and symptoms occur, with these variations: instead of hypertrichosis, hypotrichosis obtains, and, in the genital sphere, loss of libido with atrophy of the testicles.

In the female, before puberty, the same findings occur except that there is evidence of precocious sexual maturity, as manifested by menstruation and the size of the genital organs.

Hypertrichosis, with masculinization of the female, without hypertension has been described in the arrhenoblastomas of the ovaries, which have recently been discussed by Novak.[5]

Cushing[2] reports 385 verified cases of pituitary adenoma; of these 277 were chromophobes, 107 were acidophilic and "mixed," and one basophilic. He has, however, searched the literature and has discussed seventeen cases of what he thinks were basophilic tumors of the hypophysis.[3] In ten of these seventeen cases, definite post-mortem and histological evidence of basophilic adenoma was found. In four, there is presumptive evidence. Tumors were found. The tinctorial properties of the cells of these tumors were not established. In two, the pituitary was said to be normal, grossly, and no histological examination was made. In one, his prediction was proven absolutely wrong. This was a case of carcinoma of the thymus, with a normal pituitary, grossly and histologically. The adrenal glands were reported enlarged and hyperplastic.

It would lead us too far afield to attempt a discussion of a correlation of the clinical picture and the dysfunction of the endocrine system in this type of case. Using the acidophilic adenomas as an example, there is no question but that they modify, anatomically and functionally,

the other glands, particularly the thyroid, the adrenal, the pancreas and the gonads. If basophilic adenomas are of a hypersecretory type, the assumption that they modify the other glands of internal secretion is justifiable. Anatomically, outside of the gonads, there is not much evidence of this effect.

Obesity is notoriously a symptom in dysfunctions of the hypophysis, whether they are hyperactive or hypoactive types. The physiology of the pituitary is as nebulous today as was the thyroid yesterday. The interrelation of the adenohypophysis and the neurohypophysis and its stalk, is a hodge podge of experimental, histological, neurosurgical and clinical observations as well as assumptions. In adiposa dystrophia genitalis there is a tendency to attribute adiposity to changes in neurological areas near the base of the stalk and not to the pituitary itself.

Tolerance for sugar is a definitely established fact in hypopituitary states. Intolerance for sugar is notorious in acromegaly and what is now purported to be hyperactive states of the basophilic cells. Whether this tolerance is due to an inhibitory action on the islets of Langerhans, or peripherally as an antagonistic insulin effect, is unknown.

The hypertension is difficult to explain. Cushing attributes it to excess of neurohypophyseal secretion. Compatible with this is the fact that in chromophobe cases, which compress the posterior lobe out of all recognition, invariably there is a subnormal blood pressure. Whether the hypersecretion of the basophilic cells stimulates posterior lobe activity is not clear.* Heretofore the vascular hypertension of polyglandular disorders has been ascribed to adrenal sources. The hyperplasia of the adenals associated with basophilic adenomas occurs in the cortex. It is in the medulla that epinephrine is elaborated.

The osteoporosis is hypothecated as being due to a stimulation of the parathyroids. Hyperplasia of the parathyroids has been described in some of the cases. One adenoma is mentioned.

The adrenals are described as hyperplastic in most instances. This is true also in acidophilic tumors. Adenomas of the adrenals were found in two cases. In one case an adrenal rest was found in an ovary.

The fact that is most contradictory in this group of cases is the effect on the ovaries. Invariably there is cessation of ovulation and atrophy of the ovaries, to say nothing of the atrophy of the genital organs. If the basophilic cells elaborate gonadotropic hormones, which stimulate folliculization and luteinization, why do we not find this present in these cases of basophilic adenoma? There is no answer to this question. Nor is there an answer to the question: Why does this tumor initiate precocious sex activities in the immature and stop sex function in the mature?

Cushing does not discuss the cause of the hypertrichosis. It is possibly a hypogonadal effect.

I might quote his end remark on a discussion of these topics:[8]

> "While fully believing the adenohypophysis is the root of all this evil relating to the disturbances of growth and sexual activity, it seems almost too much specifically to charge it with thyroid activating; glycogenic, lactogenic and menstrual-initiating properties and other crimes of like sort, for which its subordinate accomplices may well enough be responsible."

Whatever we may think of this syndrome, at any time we may be embarrassed by a similar problem, as was Cushing[3] recently. This patient showed precocious adolescence at ten, associated with normal menstruation, which continued for three years, then abruptly ceased. She acquired a plethora with hirsuties; she became increasingly abdominous with striæ. She had persistent backache with decalcification of vertebræ; and an abnormal calcium output. A spontaneous fracture of the pelvis occurred, which healed with callus. She had a lowered metabolic rate, lowered tolerance for carbohydrates and a high blood pressure. Her urine contained a substance which gave the Aschheim-Zondek tests for pregnancy. Following x-ray of her sella, her backache disappeared, her blood pressure became normal, her abdominal striæ lost their bright color, her menses returned seven months after the x-ray therapy, her urine lost the Aschheim-Zondek body. The hirsuties is disappearing.

Dr. Richard Johnson and I have considered a patient who has some of the clinical specifications of the one just related. A few years ago we would have considered an exploratory operation on the adrenals. Today, we are debating whether we should use x-ray therapy on the

*Cushing recently (Am. Jour. Path., 10:145, March, 1934) has called attention to the invasion of basophilic cells into the pars nervosum in conditions such as eclampsia and hypertension.

sella. Three cases of this type have been treated by radiation: case 11 of Chicago,[2] Cushing's fifteen year old girl mentioned above and the present case. The Chicago and Boston cases showed improvement. Ours did not.

In conclusion: A case is reported which has most of the hall-marks of the cases described by Cushing, as a syndrome due to basophilic adenoma of the pituitary. At post-mortem a tumor of the anterior lobe was found. Professor Rasmussen of the University of Minnesota identified the cells of this tumor as basophilic in type.

Addendum: Since this was presented, several reports have come out verifying Cushing's observations. A report by Russell and Evans[6] is of particular interest since they describe variants from the original clinical picture. Jamin's[4] report is of interest in that the patient responded to x-ray therapy.

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Summary of Symposium on Recent Acquisitions in Endocrinology

Dr. R. M. Wilder (Rochester, Minn.): If we stop to reflect on the difference between the symposium we have just heard and the kind of thing we used to hear in endocrinology only a few years ago, we will appreciate fully what an advance has been made in this field. This was then a fertile field only for charlatanism, since the endocrine preparations then available were for the most part without biological effectiveness. But today we are dealing with chemically pure substances, crystalline hormones, as Dr. Kendall has shown us in the case of the cortical hormone, or with preparations that are standardized in a very precise manner, so that we know we are dealing with substances of real activity. Methods of diagnosis have been developed based on the use of these active substances as well as new methods of treatment.

Endocrine conditions of which we were formerly unaware have been brought to our attention during the decade. Dr. Borg presented a classical instance of one of these, a syndrome that results from overfunction of the parathyroid glands. Nearly all of the cases of it have shown tumors, adenomas of the parathyroids, but recently from Boston, Albright, Bauer, and Churchill have described simple hyperplasia with hypertrophy of the parathyroids giving rise to a symptom-complex exactly like that which we have seen in cases with tumors. They point out that a subtotal ablation of the parathyroid tissue in these cases will lead to as much clinical improvement as is seen following resection of parathyroid tumors. They point out the analogy between this condition and hyperplasia and hypertrophy of the thyroid gland in hyperthyroidism. They demonstrate very interesting microscopic preparations to show a difference in the appearance of the cells of hyperplastic parathyroids and those of adenomas of the thyroid. The adenoma cell looks very much like the chief cell of the normal parathyroid gland. In the hyperplastic and hypertrophied glands, the cells are larger and clearer. Thus the surgeon who is operating in a case of hyperparathyroidism, when he encounters a parathyroid gland, removes that gland and can tell from examination of it whether to expect hyperplasia of the other glands. If he finds a tumor at his exploration and the histology of this tumor indicates a tissue that looks like the chief cell of the normal gland, he knows his operation is over. If he encounters a hyperplastic gland, he must look further, expose the other parathyroids and remove enough tissue so that clinical benefit can be expected.

Dr. Ulrich and Dr. Hoffman both referred to the clinical syndrome that Dr. Cushing has been calling pituitary basophilism. The syndrome, as has been pointed out, is a syndrome that we have in the past considered as due to overfunction of the adrenal glands. The same syndrome exactly, so far as we have been able to determine, is produced by cortical tumors of the adrenals. The same syndrome has been seen in cases with hyperplasia and hypertrophy of the adrenal glands in the absence of evidence of abnormality of the pituitary.

Recently, Dr. Walters described the results of the operation subtotal adrenalectomy in a case with hyperplasia, the operation being followed by marked clinical improvement. In some cases of this syndrome the pituitary is at fault, but in the majority the adrenal is the gland that is primarily responsible.

Dr. Kendall's observations are impressive. We have been dissatisfied with the treatment of Addison's disease for two reasons: In the first place, the cost of the cortical hormone on the market has been so high that nobody but the millionaire could afford to have this disease, and because of the cost of the preparation we have not given large enough doses to be effective in all

cases. In the second place, the preparations on the market have been of varying potency.

The first step for the chemist in a program to synthesize such a product as this, is its isolation in crystalline purity. When he has taken that step, we can expect him to learn how to make the product. If this synthesis can be completed in the case of cortin, it is to be hoped that the preparation can be placed on the market at a very much lower cost than at present.

The significance of the pituitary in physiology cannot be doubted. Tremendous increase in the knowledge of the functions of this gland has been accomplished recently, and still I am somewhat skeptical about calling this gland a "master gland" as is now the custom. It may be a master gland in physiology, but I question whether it has a comparable importance in pathology and clinical medicine, and I am very doubtful whether our conceptions of metabolic diseases such as hyperthyroidism and diabetes will be altered by the discovery that the pituitary elaborates something which we call a thyretotropic hormone or diabetogenic hormone. I appreciate the influnce of the pituitary in physiological regulations, but I think we must preserve a certain amount of reserve in applying the new knowledge to our clinical problems.

FRACTURES OF THE LOWER END OF THE RADIUS*

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SINCE Colles, in 1841, first described the fracture which bears his name, an amazing number of articles have been written on this subject and it would seem that any further writing must be repetitious. That is largely true but recent studies of end-results are quite disappointing and the lack of unanimity in the treatment advised by the recognized authorities is disconcerting.

The classification of fractures of the lower end of the radius has been sufficiently well standardized. It is a convenience to have the terms Colles' fracture, Smith's fracture or reversed Colles, Barton's fracture or fracture of the posterior joint edge. They are all related fractures. They are the result of the peculiar anatomy and mechanics of this region and an understanding of this fact will largely explain the type of fracture and aid in its treatment.

All of these fractures of the lower end of the radius are due to an end thrust with the wrist bent. An exact end thrust might be conceived such as a blow with the fist but this would hardly cause a fracture in this region. The most frequent cause of such a fracture is a fall on the hand with the hand extended and pronated. When man learned to walk on two feet his fore limbs became beautifully adapted to their prehensile function but they lost their weight bearing usefulness. An involuntary assumption of the quadrupedal posture—in plain English, a fall on the hands—is apt to be disastrous. This violent backward bending of the hand is resisted by the hand flexors and by the volar radiocarpal ligament. The pull of this ligament causes an angulating strain on the end of the radius which is translated into compression strain on the dorsal side and tension strain on the volar side.

The tension on the volar surface of the wrist is resisted by the reinforcing action of the powerful flexor tendon. If they were severed the fracture would open up on the volar side like a fracture of any long bone. In no other part of the body does a similar condition exist, that is, a relatively large cancellous bone reinforced by powerful tendons in intimate contact with the bone. These flexor tendons are automatically rendered tense by the hyperextended position. They tend to prevent the fracture from gaping In the adult bone, which is largely mineral and is relatively resistant to compression strain, it seems reasonable to suppose that the crack starts on the volar side in spite of the flexor tendons. They, however, prevent the bone from opening up wide. They act as a sort of leather hinge and as the hand is forced back, tending to angulate and displace the radial fragment, this fragment is pinched between the carpus and the end of the radial shaft, much as one might crack a nut in the hinge of a door. The fragment is crushed down on the end of the shaft. In children the bone is much less resistant to compression but more to tension and the ordinary frac-

*Read before the Minnesota Orthopedic Society at the annual meeting of the Minnesota State Medical Association, Duluth, July 16, 1934.

ture in this region is a buckling of the posterior shell of cortex, the anterior shell remaining intact. It is this combined crushing and angulating force which plays havoc with the distal fragment, driving it down onto the more resistant shaft like a cap, impacting the ends and often comminuting the fragment. The type of fracture is determined, it is evident, by the amount of force, the angle at which it is applied and individual resistance. It may vary from a mere crack to complete backward displacement in spite of the restraining flexor tendons.

The triangular fibrocartilage and the radio-ulnar capsule play a part in the ultimate position of the distal fragment. It will be remembered that the joint cartilage on the end of the radius is continued across the free end of the head of the ulna to form the triangular fibrocartilage, the apex of which is inserted into the base of the ulnar styloid. That portion of the wrist capsule going to the ulna is inserted into the border of the fibrocartilage and then is continued upward to form the radiocarpal capsule. The radiocarpal capsule is a lax structure attached to the radius along the ulnar notch and to the ulna above the head. It is not an orbicular ligament. The radius is held in contact with the ulnar head by means of the fibrocartilage only. The radio-ulnar capsule must be lax in order to permit the normal rotation of 140 degrees. Consequently when the hand is bent back beyond its physiological limit the carpo-ulnar portion of the wrist capsule attached to this lax capsule exerts almost no strain on the head of the ulna and it is rarely ever broken. The internal lateral ligament of the wrist joint which is attached to the ulnar styloid, however, often causes this to be avulsed. As the radial fragment is forced backward there is nothing to limit this motion on the radial border, but the ulnar border is anchored to the ulna by the fibrocartilage. If this band remains intact, and it is probably not often torn, there is a tendency for the fragment to be rotated on the end of the radius in the sense of supination.

Prognosis.—Not many end-results could be obtained from the literature and those obtained did not check any too well. Edwards and Clayton[3] studied 321 results in King's College Hospital. Their findings were based on a questionnaire filled out by the patient. All who were able to hold down their old jobs were classed "perfect." They found 73 per cent perfect, 23 per cent good and 4 per cent bad. Gasby and Trick[4] in Guy's Hospital examined personally about fifty cases. All without displacement were perfect. Of the rest they found 50 per cent bad, 37.5 per cent fair and 12.5 per cent poor. Dunn[2] made a careful study of fifty cases for Minnesota industrial insurance rating. These were cases from various surgeons. The average disability was 15 per cent. He emphasizes the uniformly bad results from incomplete correction. He thinks 90 per cent perfect reduction should give not over 5 per cent loss of function. Platt,[6] in a comprehensive report, gives no statistics but admits many bad results. Steindler[7] states that disalignment is of importance mainly as a cause of secondary arthritis. Fractures into the joint are prone to cause arthritis even if alignment is perfect.

Diagnosis in a silver fork deformity or a reversed Colles is evident on inspection but intelligent treatment requires an accurate visualization of the fragments and this can only be obtained by means of the x-ray. An examination of a fairly large number of films taken before and after setting showed either that the operators had to do a lot of guessing on some of the x-rays or they were much more skillful than the writer in interpreting x-ray shadows. The anteroposterior views were easy to read and showed the general line of the fracture excellently. The lateral views, which must be depended upon in visualizing the backward angulation and displacement, the impaction, and the twist or supination, were often most confusing. This is due to the fact that the lateral view really is an end view of the distal fragment and is consequently foreshortened. The superimposed ulna may add to the confusion. It is sometimes helpful to repeat the lateral view with about 20 degrees supination and with the tube slightly distal to the true vertical to conform to the obliquity of the joint.

The writer once saw a delivery boy get a fracture from a backfire. He sat down on the running board in evident distress. An extreme silver fork deformity made the diagnosis. Under pretense of examining the wrist a sudden manipulation was carried out taking a fraction of a second. The normal contour returned to the wrist. A temporary splint was applied and the boy instructed to report at once for an x-ray. Four weeks later he showed up. He had worked every day. The wrist was 100 per cent perfect.

This case proves that this boy's clean-cut fracture taken early was easily reduced and that is all it proves. Soon after this a fracture in a seventy-year-old woman was set under gas thirty minutes after her injury. It was set again at three weeks and again at three months. She was finally discharged after seven months with union but with deformity and less than 25 per cent motion in wrist or fingers. Such a case is spoken of as a reproach to the profession. It certainly is a challenge.

Treatment.—The ordinary case without much impaction can be set by any of the recognized manipulative methods. Sir Robert Jones taught the following method, which is probably used more extensively than any other method. The operator places the right hand against the fractured right wrist with the thenar eminence exactly over the distal end of the radius. The operator's left hand is against the back of the patient's wrist with the thenar eminence in contact with the distal radial fragment. The operator's hands are then forced together, at the same time exerting traction and forcing the fragment into flexion and pronation.

With a clear visualization of the displaced fragment as seen in the x-ray, the manipulations necessary for its replacement work themselves out as a logical sequence. First, backward and forward rocking to free the impaction. Then separate the jagged cap-like fragment from the equally jagged end of the radial shaft by leverage against the head of the ulna and by direct traction. Then slide and rotate the fragment forward and into pronation by pressure of the thumbs on the fragment and counter pressure against the end of the radius and the head of the ulna. Then, and not until then, force the fragment downward to completely correct the dorsal angulation. This may require some force if the ends have been badly crushed and misshapen. The hand should then hang by its own weight in full flexion. If it does not, repeat the operation. Full flexion may result in a gaping of the fracture line. Such cases are relatively unstable and require splinting for ten days in full flexion.

The most efficient and comfortable immobilization is obtained by means of the anterior and posterior plaster splint, preferably unpadded. There are now on the market dustless plaster-of-Paris strips 15 inches long that are extremely convenient and make a remarkably strong, light splint. Six or eight of these cut to length are drawn through water and gently kneaded to place. They set very rapidly. They should extend to the knuckles on the back and to the midpalm in front. These plaster shells should never touch each other on the sides.

Haggart[5] believes that Colles' fracture in old people constitutes a very difficult problem. Much crushing is the rule and frequently comminution occurs. He uses prolonged traction in setting with a padded strap above the elbow for counter traction. The splints are applied before the traction is released. He recommends the "sugar tong" splint, which consists of one long strip of plaster extending from the knuckles around the padded elbow to the palm. This splint is used to prevent supination and pronation. He keeps the original splint on five to seven weeks in bad fractures.

Strong traction in setting is advised by many recent writers. Boehler paints the first, second and third fingers and thumb with "mastisol," a glue-like fluid, over which he applies a gauze bandage. The assistant then seizes the thumb in one hand and the three fingers in the other without danger of the fingers slipping. Ten per cent solution of Venice turpentine in alcohol can be substituted for the mastisol. Caldwell[1] gets a grip on the fingers with "finger traps." These finger traps are familiar children's toys which tighten as the pull is increased. Magnuson uses a loop of strong bandage about the wrist, which extends around the operator's shoulder, with which a steady pull can be exerted until the muscles are relaxed. After this the fragments are kneaded into place by direct pressure much as they are by the manipulative method. A careful study of any series of x-rays will show many cases that are so irregular and so comminuted that no simple maneuver without forcible and prolonged traction can be expected to restore the normal relationship of the fragments. When the damage that must have been inflicted on the tendons and their sheaths by the original injury is considered and the possible development of secondary arthritis, 100 per cent perfect results in all cases cannot be expected under any form of treatment.

Summary

Fractures of the lower end of the radius are characterized by crushing of the fragments and frequent destruction of bone structure.

Treatment should be more selective, based on a more careful reading of the x-rays.

Prolonged traction is often necessary for satisfactory setting.

Unstable cases require more efficient and longer splinting than is ordinarily used.

Early movement is most desirable but position must be preserved. Stiffness from disalignment is more persistent than stiffness from long splinting.

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FRACTURES OF THE CARPAL NAVICULAR BONE*

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FRACTURES of the carpal scaphoid or navicular bone are the most frequent of the somewhat uncommon carpal injuries but with our present knowledge of the symptoms and signs there is little excuse for a failure to diagnose this condition and to institute proper treatment. Radiographs are, of course, essential and necessary for exact diagnosis, but, failing these, the clinical picture is clear enough in most cases to prevent a diagnosis of "sprain" and the subsequent disability which will always follow as a result of improper treatment. The x-ray should be used routinely if possible in all wrist injuries and both antero-posterior and postero-anterior views are necessary in addition to the usual lateral ones if no lesion is to be overlooked. Most mistakes are made, however, not by misinterpreting the radiographs but by failure to use the x-ray at all.

The proper conception for the treatment of navicular fractures can only be obtained by an understanding of the underlying anatomy and pathology and this brief review of such fractures must start with this foundation.

The navicular is located on the lateral end of the proximal row of carpal bones and although it can be palpated for a portion of its extent it is deeply placed between the articular surface of the radius and the distal carpal row, being well protected against direct injury but in great danger from indirect violence. It is held loosely in position by ligaments through which it also obtains its blood supply and is largely bathed in synovial fluid. A thin compact layer surrounding a spongy core makes up the body of the bone, which is narrowed near its middle or neck and has an enlargement on its lateral side called the tubercle to which the lateral radiocarpal ligament attaches.

The exact mechanism and cause of navicular fractures is not absolutely clear but seems to be rather complicated. Violence received by a fall on the outstretched and abducted hand or the jerk of a crank handle in an automobile backfire is transmitted through the capitate bone against the weak or thinner portion of the navicular body, which is locked against the radius, and results in a "snap" type of fracture if the force does not break the radius or is not disseminated otherwise. Injuries received with the hand in adduction may result in the rare lesion where the radiocarpal ligament pulls the tubercle from the body, a true sprain-fracture.

There is no question of the violence required to cause a navicular fracture and the patient remembers, many times only too clearly, the exact time of the injury, the way the violence was applied, and the sudden onset of swelling. These

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facts should assist in ruling out the presence of congenital bipartite navicularis in cases of questionable old fractures.

Pathologically, as has been stated, there are two sites where fractures may occur: the tuberosity rarely, and the body more commonly. In the tuberosity cases the fracture line is through the region to which the lateral radiocarpal ligament is attached and, therefore, is extra-articular. There is no hemorrhage into the joints, the vascularity of the fragments is good and bony union usually occurs very readily.

When the body is broken the line of fracture passes, as a rule, through the thinnest or weakest point at about the junction of the lateral one-third with the medial two-thirds. It may extend for only a portion of the way across the bone, producing the so-called "green-stick" fracture, or it may be complete. In the former there is no displacement or separation of fragments, the circulation of the bone is practically undisturbed and union is certain.

In the latter type, separation of the fragments is very uncommon unless accompanied by other injuries such as dislocation of the lunate bone or fractures of the radius. There is some difference of opinion in the literature regarding the amount of interference with the blood supply in these fractures and some writers state that the vascularity of the distal fragment is always better than that of the proximal, but this can be questioned, as the bone obtains its blood supply through the ligaments at its ends, and these are very rarely, if ever, ruptured.

Healing is quite typical of that seen in all cancellous bone, depending as it does largely upon the abundance of so-called endosteal callus formation. In experimental fractures the healing response has been found to develop as early as that in long bones but it is more local in its extent and less active. Defects in the surface of the bone or cartilage heal by fibrous tissue as no periosteal bone develops. The fact that the fragments are bathed by synovial fluid does not apparently in any appreciable way affect their healing. It is agreed that the first step in union is the crossing of the fracture line by delicate blood vessels and connective tissue, binding the two fragments together, and that callus develops following this and bony union takes place with the deposition of calcium salts. Inadequate fixation allows motion between the fragments with shearing of these delicate vessels, followed by necrosis and fibrosis of the bone adjacent to the line of separation, and non-union or fibrous union results.

The diagnosis of navicular fractures is based on several correlated factors. A painful wrist, with swelling localized chiefly on the radial side, following a fall on the outstretched hand should always make one think of the possibility of such a lesion.

In most cases a typical history can be obtained of a severe fall on the hyperextended hand or that the backfire of an automobile caused a sudden upward push of the crank against the hand with immediate disability. Seldom is it found that direct blows over the wrist are responsible for these fractures. Loss of grip in the hand, pain on motion of the wrist, particularly in extension, tenderness on palpation in the anatomical "snuffbox" at the base of the first metacarpal, swelling which is limited usually to the radial side of the wrist and does not extend up or down along the tendon-sheaths, absence of deformity, crepitus, and ecchymosis, and a positive reaction to Vaughan's test, which consists of pressure on the third metacarpal in its long axis, producing pain in the wrist in the region of the navicular bone, all point suggestively to the fracture under discussion.

The exact type and location of the fracture can always be demonstrated by x-ray examination although it is frequently necessary, as has been suggested, to have views taken from various angles in order to get the navicular to stand out in proper profile. It is always well to look for carpal fractures when studying radiographs of injuries to the lower ends of the forearm bones or to metacarpals, as frequently these are associated with carpal injuries.

An old fracture of the navicular can very often be diagnosed by the history of persistent swelling of the wrist accompanied by weakness of the grip and pain on attempted motion. The radiograph readily demonstrates the widening of the fracture line due to necrosis and fibrosis or non-union with cavitation. Unfortunately for the patient there has usually been a diagnosis of sprain with inadequate fixation, and an early return to work insisted upon as a result of failure to obtain satisfactory radiographs.

Congenital anomalies occur in the form of the rare "bipartite" navicular bones and these must

not be confused with fractures. They are usually bilateral, the divisions are very regular in outline and would hardly confuse one if the possibility of their occurrence is kept in mind. The absence of history of injury assists in ruling out fracture.

The treatment of these fractures, as has so adequately been stated, "is immobilization, immediate, complete and prolonged." If one starts with this knowledge and properly applies it, bony union occurs in almost all cases. All surgeons agree that early fixation is of prime importance, as it allows the delicate network of blood-vessels to develop across the fracture line with no delay or later interference. By far the best method of fixation is the unpadded plaster-of-Paris dressing which can be applied without an anesthetic and changed later if much swelling was present, primarily so that the plaster becomes loosened. The plaster should extend from the palm of the hand to the upper portion of the forearm and must include the thumb to beyond the metacarpophalangeal joint. The hand should be moderately adducted and the thumb in the opposed position. In this dressing the fingers can be moved freely and yet there is absolutely no chance for the navicular fragments to be moved on each other. In the hands of some experienced surgeons a plaster-of-Paris posterior splint extending from the metacarpophalangeal joints to the elbow with the wrist in a slightly cocked-up position has proven ideal. It may be moulded accurately on the skin or over a thin layer of padding so as to produce a perfect immobilization of the wrist and still allow the use of the fingers. This freedom in either method stimulates the blood-supply and prevents atrophy of the bones as a result of disuse, in spite of prolonged fixation.

The length of time a navicular fracture is held fixed must be at least six to eight weeks and the general trend is toward the longer rather than the shorter periods. If this is carried out bony union is obtained in almost all uncomplicated cases. Free motion of the wrist and fingers is obtained at once or within two weeks following the removal of the splint if functional use of the fingers is maintained during the period of fixation.

This rather prolonged but absolutely necessary treatment is entirely different from that followed by earlier writers who advised removal of fixation after a few days for active and passive motion of the wrist joints and resumption of function in spite of pain. Frequent recurrences of painful swelling and loss of strength meant repeated reapplications of splints, a prolongation of disability and fibrous union or non-union.

Old ununited and painful navicular fractures need only be touched upon here. Conservative treatment consisting of prolonged fixation in non-padded plasters for even six or eight months will give a certain number of cures and should always be tried before any operation is undertaken. Removal of one or both fragments always leaves a disabled wrist, although there are times when, on account of extreme pain, this may be necessary. Bone grafting of the fragments has been done with some success but will never be a method of choice for routine procedure and is mainly a surgical stunt.

In closing this very brief discussion of carpal navicular fractures two points must be reëmphasized:

1. All injuries to the wrist, no matter how slight, should be carefully examined for carpal fractures. The x-ray is of the utmost importance in this connection and a diagnosis of sprain should never be made without a clearly negative film to back it up.

2. Treatment must be immediate, and absolute fixation for nearly eight weeks is essential for a proper result. With it, practically all fresh fractures will heal with no residual disability.

MALUNITED FRACTURE OF THE LOWER END OF THE RADIUS (COLLES' FRACTURE) TREATED BY OSTEOTOMY*

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THE majority of fractures of the lower end of the radius are treated with satisfactory results, yet on the fracture service of any clinic one is not infrequently confronted with the problem of treating the disabling deformity which results from malunion of such fractures. Thus in a series of 250 cases of fracture of the lower end of the radius seen at The Mayo Clinic in the last ten years, twelve patients, or 4.8 per cent, presented themselves at the clinic because of malunion with disability. This deformity is almost always due to one of three factors: (1) failure to reduce the fracture properly, (2) failure of the retentive apparatus to hold the fragments in proper position, or (3) failure to immobilize the fracture for a sufficiently long period of time. It will not be our purpose in this study to discuss the primary treatment of these fractures, since this phase has been fully covered by numerous investigators. The report will be entirely limited to the description of a method for correcting a deformity due to malunion and to presentation of the end-results in twelve cases in which treatment was carried out by this method.

In a previous paper one of us (Meyerding)[3] reported a case of malunited Colles' fracture and, about the same time, Ghormley and Mroz included four similar cases in their paper on fractures of the wrist, all of which are included in this study. In a review of the literature we were unable to find any other group of cases of this type in which treatment was by osteotomy. Hoag reported four cases of fracture of the distal end of the radius with deviation of the hand due to shortening of the radius. He treated these fractures by resection of the lower end of the ulna, with satisfactory results. Thornton has offered a method of correcting the deformity in these cases by performing an oblique osteotomy along the line of the junction of the new and old bone. He then removes a wedge-shaped piece of bone from the shaft of radius equal to the length of the osteotomy, and then manipulates the fragments into position. No cases are reported.

Deformity and Disability

The common deformity in malunited fractures of the lower end of the radius is produced by backward tilting as well as by dorsal displacement of the distal fragment (Fig. 1). In production of this deformity, the distal fragment, carrying the wrist and hand backward and upward, produces backward tilting of the joint surface of the radius, radial shortening, and slight supination and deviation of the hand. Malunion will occur unless this displacement is corrected and an approximately anatomic relation produced and maintained until union is satisfactory. Thus, with a malunited fracture, the normal relationship of the carpal-radial articulation is disturbed and motion at the wrist-joint may be impaired.

In the more serious injuries it not infrequently happens that the styloid process of the ulna is fractured and displaced, which results in an increased deformity and disability. It has been our experience that this disability prevents flexion of the wrist and closure of the hand, often resulting in complete loss of income and in permanent, partial disability. Among highly technical workers, the disability is often of serious consequence and, for a musician, stenographer, or machinist, it may necessitate a change of occupation.

Operation

The operation is carried out after application of a tourniquet with the patient under general or brachial block anesthesia. A dorsal incision 1½ inches (3.8 cm.) in length is made longitudinally over the lower end of the radius. Transverse osteotomy is then performed along the line of fracture, extending almost through the bone but leaving a thin layer anteriorly along with the periosteum. Then, by manipulation, the backward displacement is corrected and the radius realigned. This separates the fragments dorsally but leaves them in contact anteriorly. In treat-

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ing the deformity by this method, the radial shortening is also corrected, thus usually completely restoring the normal anatomic relation between the lower end of the radius and the

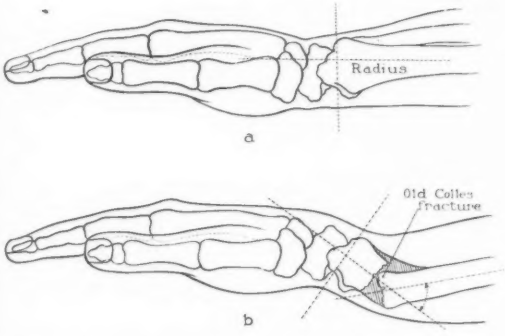

Fig. 1. *a*, Normal relationship. *b*, Old Colles' fracture with malunion of radius, showing dorsal displacement of distal fragment, incongruity of joint, dinner-fork deformity, and formation of new bone.

other structures of the wrist-joint. The new bone which is piled up on the dorsal surface of the radius adjacent to the site of fracture is next removed with a chisel (Fig. 2). This relieves the thickening on the dorsum of the wrist, and the bone which has been removed from this site may be used as a wedge to hold the radial fragments in alignment, if it is deemed advisable. In a few cases no excess bone is present on the posterior surface of the radius, and in these cases the wedge of bone may be taken from the shaft of the radius or from the tibia, if it is thought advisable to use a wedge. However, in the majority of cases, fixation of the wrist in acute flexion will maintain the fragments in correct alignment without the aid of a wedge. After the operation has been completed, the wound is closed without drainage and a plaster-of-Paris cast is applied from the fingers to the middle of the arm, with the wrist in acute flexion and the elbow at right angles. A cast applied in this manner assures complete immobilization and maintenance of the fragments in proper alignment. The cast is usually changed at the end of two or three weeks and the stitches are removed. The second cast is then worn from six to eight weeks longer, although it is usually bivalved earlier to allow active motion and massage. If this is done the two halves of the cast are fastened securely with straps to prevent any possible displacement.

In some instances it may be desirable to make a ventral incision and do an osteotomy or to remove a wedge of bone to correct deformity, as in Case 12. Physiotherapy is a very useful aid

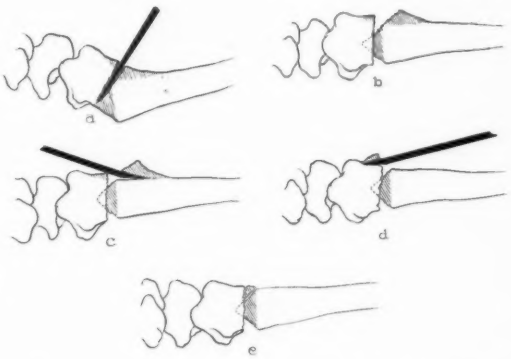

Fig. 2. Osteotomy for malunited Colles' fracture. *a*, Line of osteotomy. *b*, Malalignment corrected. *c* and *d*, Removal of excess bone from proximal and distal fragments. *e*, Malalignment of radius corrected, fragments impacted, and wedge-graft inserted.

in correcting postoperative stiffness and should be carried on together with active motion. The earlier the patient begins to use the extremity, the sooner will osteoporosis and stiffness be overcome.

Reports of Cases

Case 1.—A woman, twenty-five years of age, was seen at the clinic in February, 1926, because of a malunited fracture of the right radius just above the wrist. There was typical dinner-fork deformity. The fracture was manipulated under anesthesia and splints were applied. When the splints were removed five weeks after the injury, the deformity was noted, the fragments apparently having slipped following reduction. Two months after the injury occurred, osteotomy was performed along the line of fracture and the deformity was corrected. A plaster-of-Paris cast was applied from the fingers to the middle of the humerus with the wrist in acute flexion. The patient made an uneventful recovery and an excellent result was obtained (Fig. 3).

Case 2.—A woman, twenty-one years of age, came to the clinic February 26, 1927, because of a fracture of her left wrist. The injury had occurred one month previously. At that time, the fracture had been manipulated under anesthesia and splints had been applied. The patient had come to the clinic because the deformity had persisted. Examination disclosed an old malunited fracture of the left radius just above the wrist with dorsal and upward displacement of the distal fragment. The wrist was displaced backward, preventing flexion of the hands and closure of the fingers. At operation, osteotomy was carried out along the old fracture line and the fragments were manip-

ulated into position. A plaster-of-Paris cast was applied from the fingers to the middle of the arm with the elbow at right angles and the wrist in 60° flexion.

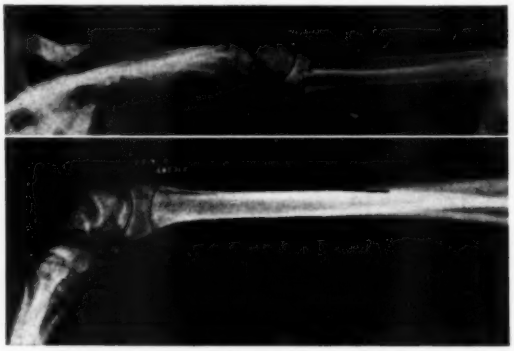

Fig. 3. *(Above)* Malunited Colles' fracture two months after injury. *(Below)* Postoperative result following osteotomy of the radius.

Recovery was uneventful and an excellent result was secured (Fig. 4).

Case 3.—A widow, fifty-two years of age, was admitted to the clinic August 24, 1927, with an infected compound fracture of the lower end of the right radius; this had occurred seven weeks previously. Examination revealed two draining sinuses over the right wrist and a fracture of the lower end of the radius in malposition. The wrist was dislocated ventrally and the lower end of the ulna was also dislocated. The patient was returned to the care of physicians at her home until all infection had disappeared. Two months later the wounds had healed, but the patient did not return until six months after her previous dismissal. At this time she was unable to move the wrist or to close her fingers. At operation, the lower end of the dislocated ulna was removed and an osteotomy of the radius was performed from the ulnar side. The deformity was then corrected as much as possible. A large block of bone on the ventral surface of the radius was then removed through an anterior incision. A plaster-of-Paris cast was applied from the middle of the arm to the fingers. There was a little serous drainage from the wound, but otherwise recovery was uneventful. A fair functional result was obtained. The wrist remained stiff, but extension of the fingers was normal and flexion about 80 per cent of normal.

Case 4.—A business man, twenty-four years of age, was admitted to the clinic September 3, 1927, because of a deformity of the right wrist resulting from a fracture which had occurred six weeks previously. Examination disclosed a malunited fracture of the distal end of the right radius and dislocation of the lower end of the ulna with dinner-fork deformity. At operation, osteotomy was performed along the line of fracture. The fragments were then manipulated into excellent position and held there by a beef-bone plate. The dislocation of the lower end of the ulna was reduced. A plaster-of-Paris cast was applied from the fingers to the shoulder with the elbow at right angles and the wrist flexed. Excellent position was obtained. The patient was allowed to go home, at his request, at the end of three weeks after having had the cast changed and the stitches removed.

Case 5.—A child, ten years of age, was admitted to the clinic September 12, 1927, because of a fracture of the lower end of the left radius and ulna, which had occurred two weeks previously. The family physician had been unable to reduce the fracture. Examination revealed a fracture of both bones of the left forearm. The callus and displaced fragments were separated with a chisel and manipulated into position. A plaster-of-Paris cast was applied with the wrist in flexion. Recovery was uneventful and an excellent result was obtained.

Case 6.—A farmer, twenty-eight years of age, came to the clinic October 18, 1927, complaining of a deformed left wrist. Seven years previously he had fractured this wrist. At that time two attempts had been made to reduce the fracture but without success and, as a result, the fragments had healed in malposition. Examination disclosed the old malunited fracture of the distal end of the left radius. Dinner-fork deformity was present. All movements of the wrist and hand were markedly limited. There was considerable shortening of the radius. At operation, osteotomy was performed along the old fracture line and the deformity was corrected. This partially relieved the radial deviation of the hand. A cast was applied with the wrist in flexion. Two weeks later the lower end of the ulna was resected. This completely corrected the radial deviation. Convalescence was uneventful and the patient secured a very good end-result.

Case 7.—A school boy, sixteen years of age, came to the clinic August 20, 1928, because of a deformity of the right wrist. He gave a history of having fractured the wrist eleven months prior to his admission. The fracture had been reduced at the time but the splints had had to be removed because signs of ischemic paralysis had appeared. Later, a second attempt had been made to reduce the fracture, but without success, due to infection. Examination disclosed the old fracture of the lower third of the right ulna and an epiphyseal separation of the lower end of the radius, both of which were malunited. There was marked posterior angulation of the epiphysis. The patient was unable to flex the wrist or to close his fingers. At operation, ½ inch (1.3 cm.) of the distal end of the ulna was excised and the fragments were fastened with a beef-bone screw and chromic catgut. Osteotomy was performed along the fracture line of the radius, and the deformity was then corrected. The piece of bone, which had been removed from the ulna, was inserted as a wedge to hold the radial fragments in position. A cast was applied with the wrist in flexion. A mild, soft-tissue infection occurred, but this cleared up promptly. An excellent result was secured.

Case 8.—A boy, ten years of age, was admitted to the clinic January 5, 1928, because of a deformity of the left wrist. He gave a history of having injured the wrist one month previously. An osteopath had made a diagnosis of fracture and had applied splints for three weeks. Examination revealed an epiphyseal separation of the lower epiphysis of the left radius in malposition. The lower fragment was displaced backward, producing dinner-fork deformity. At operation, a ventral incision was made and the lower end of the radius exposed. Osteotomy was performed and the epiphysis was brought down into the correct position. A plaster-of-Paris cast was applied with the wrist in flexion. Healing took place by primary intention. An excellent result was obtained.

Fig. 4. *a*, Anteroposterior roentgenogram showing radial shortening and fracture. *b*, Lateral roentgenogram showing backward and upward displacement. *c*, Anteroposterior roentgenogram showing postoperative results after five years. The normal right wrist may be compared with the fractured left wrist on which osteotomy had been done. *d*, Lateral view.

Case 9.—A woman, twenty-three years of age, came to the clinic December 23, 1929, complaining of a disabling deformity of the right wrist. The wrist had been fractured six months previously. Three unsuccessful attempts had been made to reduce the fracture. On examination, an old malunited fracture of the distal end of the right radius was found. The distal fragment was displaced backward, making it impossible to flex the wrist or to close the hand. Osteotomy was performed through a dorsal incision at the site of the fracture. A plaster-of-Paris cast was applied with the wrist in acute flexion. This cast extended from the fingers to the middle of the arm. The patient made a normal convalescence and secured an excellent end-result.

Case 10.—A school teacher, thirty-one years of age, was first admitted to the clinic June 16, 1930, complaining of a deformity of the left wrist with an associated disability. She gave a history of having fractured the wrist two years previously. The fracture had been reduced, but a blow, occurring two days after the injury, had reproduced the deformity. Examination disclosed an old malunited fracture of the distal end of the left radius. There was typical dinner-fork deformity with an inability to flex the wrist and to close the fingers. At operation, an incision was made along the dorso-lateral surface of the wrist. Osteotomy was performed on the radius about ½ inch (1.3 cm.) above the wrist-joint. The fragments were manipulated into position and a wedge-shaped piece of bone from the tibia was inserted between the separated fragments. A plaster-of-Paris cast was applied with the wrist acutely flexed and in ulnar deviation. The patient made an uneventful recovery and an excellent result was obtained.

Case 11.—A school teacher, forty-two years of age, was admitted to the clinic November 28, 1930. She gave a history of having fractured her right wrist five weeks previously. Immediately after the injury her local physician had reduced the fracture and applied splints. On removing the splints four weeks later, the deformity had still been present. Examination at the clinic disclosed an old malunited fracture of the right radius, just above the wrist. The wrist was displaced dorsally and there was inability to flex the wrist and to close the fingers. Osteotomy was performed along the old fracture line and the fragments were manipulated into position. A plaster-of-Paris cast was applied with the wrist in palmar flexion. There were no postoperative complications. An excellent result was obtained.

Case 12.—A business man, fifty-four years of age, came to the clinic September 16, 1931. Eleven months prior to admission he had been seriously injured. Among other injuries were fractures of the left radius and ulna just above the wrist. The arm was manipulated and a cast applied without the aid of an anesthetic, since the patient was unconscious and there were injuries to the thorax. When the cast was removed twenty days later, a dinner-fork deformity was present. Examination revealed old malunited fractures of the lower ends of the left radius and ulna. The distal fragments of both bones were displaced backward. There was inability to close the fingers and to flex the wrist. At operation, it was decided that ventral-wedge osteotomies on both the radius and ulna would be the most simple method of correcting the deformity.

Accordingly, wedged osteotomies were performed on the ventral side of both bones. When this had been done, the deformity was very easily corrected. A plaster-of-Paris cast was then applied with the wrist in full flexion. The patient made a normal convalescence and obtained an excellent end-result. This case has been reported previously.[3] The end-result was not given at that time.

Comment

Malunited fracture of the lower end of the radius produces a deformity which is usually painful and one which is almost always quite disabling. The severity of the disability often forces the patient to give up his former occupation, and unless the disability is relieved, he will likely become dependent on society. In order to restore function of the extremity, the deformity must first be corrected. After the deformity has been corrected, the disability will clear up unless some previous complication prevents the return of normal function. Such complications may result either from infection or from simple contracture of the joint capsules or muscles, the latter being due to the existence of the deformity over a long period of time. Simple contracture usually can be corrected by exercise and by massage, whereas changes which occur secondary to infection will always persist to a varying degree depending on the severity of the infection.

The operation described in this paper has given uniformly good results in the cases in which it has been used. A review of the cases reported will indicate that excellent results were obtained in ten of the twelve cases. The fracture was compound in one of the other two cases. In this case, a preëxisting severe infection had developed which had resulted in ankylosis of the wrist joint and in stiffness of the fingers. However, correction of the deformity was followed by a return of function of the fingers to within 20 per cent of normal. In the other case the result is indeterminate as the deformity was completely corrected by osteotomy and the patient was allowed to go home wearing the cast. He removed the cast himself without consulting a physician and our information regarding the result is unsatisfactory.

The results in cases of malunited fracture treated by osteotomy, as described in this study, have been encouraging. The procedure is simple and involves very little risk. We believe it to be a very useful procedure in treating the quite disabling deformity which occurs in malunited fractures of the lower end of the radius.

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ACUTE FRACTURES OF THE SPINE*

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ACUTE fractures of the spine may be divided into various types. Fractures may be classified according to anatomical portion of the vertebra involved, such as the body, neural arch, and its processes, or as to whether the fracture is accompanied by cord injury. Again, fractures without cord injury may also be subdivided according to the type of lesion, as: compression, split, depressed; or as simple or comminuted, depending upon the anatomical part of the vertebra affected.

In this short paper dealing principally with the treatment, it is quite impossible to describe at any length details of the pathology or etiology of any special type of fracture except that of compression of the body of the vertebra, which constitutes about 80 per cent of the injuries of the spine proper.

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A review of the reports of several authors shows that approximately half of the cases of compression fracture involve the first lumbar vertebra; 25 per cent more are of the eleventh and twelfth dorsal or the second lumbar vertebra; 5 per cent more include the remaining portion of the cervical, dorsal and lumbar spine. Fractures of the cervical spine are usually of the split type of body and neural arch and rarely of the true compression type. The high dorsal spine is rarely involved and then frequently more than one vertebra is affected. The lower lumbar vertebra are occasionally involved in compression but more frequent the damage is to the facets, transverse or spinous process.

Compression fractures are of frequent occurrence and are often seen after trivial injuries. Cases are reported where sudden muscular contraction of spinal muscles has caused definite compression.

It is well known that any injury causing sudden and acute flexion of the spine, the so-called jack-knife position, so frequently occurring in automobile accidents, falls upon the buttocks, blows from heavy objects striking the back while in a flexed position, and injury from tobogganing or riding in a roller coaster are prone to cause compression fracture.

Symptoms of Compression and Diagnosis

In uncomplicated injuries the diagnosis is usually not difficult. A feeling of weakness in the spine may be the only complaint, but usually pain of a dull, nagging, local or referred type persists from the onset of the injury.

Examination of the spine shows limited motion, muscle spasm and rigidity, with or without deformity, usually of the knuckle or kyphotic type at the site of the injury. Definite tenderness is found on pressure over the spinous process and around the vertebræ affected. Abdominal distention, mild or severe, usually is seen after such an injury of any severity, although it may not become a prominent symptom until hours later or after manipulation.

X-ray in anterior and lateral planes is indicated following any spinal injury and it should be assumed that a patient has a compression fracture even following a trivial forced flexion of the spine until proven otherwise.

In complicated cases, the pain and suffering from other injuries or fracture may mask the spinal injury so that trivial pain and symptoms caused by compression may be easily overlooked. An early examination by x-ray after such injury is by far the safest rule.

Principles of Treatment

The principle of treatment in compression fracture of the spine is like that in other fractures: to reduce deformity to a minimum, to prevent ankylosis in neighboring joints, to break up impaction and cause broken ends to come into end-to-end position. Of all fractures a compressed body of a vertebra is perhaps the only one that has a marked tendency to correct itself by hyperextension and rest alone, and this may account for the many methods of treatment, which vary from a few days rest in bed to the extreme of spinal fusion by operation. The end-result I believe may not depend so much upon how the hyperextension of the spine is accomplished but upon a correction of the pathologic change which has taken place in the vertebræ.

The body of the vertebra, made up of cancellous bone filled with blood vessels, must, if marked compression is allowed to remain, sustain a marked damage to the blood supply to a considerable part of the area compressed. Shortening will occur as in an impacted Colles' fracture through absorption of bone if the impaction is not relieved, but if the fragments are pulled apart, new bone fills in the gap with a much better result.

The only chance of restoring the compressed vertebra and avoiding deformity is by hyperextension early and complete.

Surely hyperextension of the spine is the reverse of the force that caused the compression. The shape of vertebra with its posterior facets to pry and rest on as well as the ligamentous attachments to the anterior portion of the body of the vertebræ make good reduction possible in the largest percentage of cases. The surgeon, of course, cannot be blamed for marked interference with circulation to the body of the vertebræ with resulting atrophy, but with reduction of deformity certainly these changes are less likely to occur.

Treatment

How the hyperextension is obtained is of minor importance as long as it is accomplished.

This type of fracture does not demand expensive apparatus for its successful treatment and sufficient material is at hand in any hospital or

farm house, provided the surgeon supplies felt padding and plaster-of-Paris bandage.

During the last decade there have appeared in the literature descriptions of many methods all involving the same principle. These include simple rest in bed followed by early massage, a special type of bed which can be adjusted to the desired angle, the Bradford frame, blanket tossing, plaster shells and braces to be used after manipulation.

Rest on a flat bed in any degree of compression fracture does not meet the indication in that it does not correct the deformity. It may, however, be used for slight chip fractures. Without restraint the patient is difficult to control and may flex his spine.

Special beds (Rogers bed) will hyperextend the spine and may correct the deformity but it is often very difficult to keep a patient down the required length of time in such a bed. The Bradford frame of sanitary type properly hyperextended with ties to keep patient in position is better than a bed.

Manipulation

Tossing the patient in a blanket face down will hyperextend the spine but is rather an inaccurate method of applying force to the area affected. Some apparatus such as a plaster shell, or rest on a hyperextended bed after manipulation, is also required.

It is my belief that best results will be obtained when the amount of hyperextension and force to produce it is under the control of the surgeon and retention apparatus is then applied to maintain the position. This can be accomplished by a simple apparatus within the reach of every physician wishing to treat compression fractures.

1. Forcible manipulation on box or chairs and application of plaster jacket.

Assistants are needed to hold the patient's arms and legs. The patient is placed with the upper chest and chin and the thighs on boxes or chairs. The surgeon manipulates the affected area with his hands. A plaster jacket is then applied to the patient in hyperextension from armpits to symphysis pubis.

2. Hammock manipulation.

The patient is placed upon the abdomen on a canvas sheet or grain sack cut at the edges. This is allowed to sag until with gentle manipulation extreme hyperextension is produced. Then a jacket is applied over the patient and canvas sheet.

3. Suspension by canvas bandage.

The patient is suspended by an eight to ten inch bandage placed over the back, padded with half-inch felt, until the heels and head rest on table. A plaster jacket is then applied with the patient hyperextended.

The plaster jacket is applied from the armpits to the symphysis pubis. The plaster is well moulded over the pelvis and fracture site and a large window is cut over the abdomen to allow for the abdominal distention which frequently occurs, and this open area tends to increase the desired hyperextension. Anesthesia is occasionally used during the manipulation but most frequently a morphine hypodermic will give relaxation enough and relieve pain so that hyperextension can be accomplished.

After-Care

Usually after hyperextension and the application of a plaster jacket the first few days are stormy. Distention and vomiting often may be distressing, but usually respond to symptomatic treatment. After a week the plaster is bivalved and, with the patient resting in the anterior half, massage and heat to the spine are given and active contraction of spinal muscles allowed.

The patient may be up and about under supervision wearing a plaster corset usually for six or eight weeks. Much depends on the shape and size of the bodies of the injured vertebræ as noted in check-up x-rays.

After eight weeks a light brace or spinal support may be used while the patient is up, continuing with the posterior half of the plaster shell at night. Massage and baking, muscular contraction and lessons in posture are continued at least four weeks after the removal of the plaster jacket.

The back brace is continued from four to six months from the date of injury, and the patient is warned to constantly keep on with the hyperextended position during this time. The sitting position with the dorsal lumbar spine straight is to be especially avoided.

If this simple system is faithfully carried out by patient and physician, the greater number of cases will result in a spine permitting hard labor and one need not expect deformity, ankylosis, nerve root pain, or early arthritis as the end-result of compression fracture.

TREATMENT OF FRESH FRACTURES OF THE HIP*

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DURING these years of depression the standards demanded by the public for good functional results in fractures have unquestionably risen. When progress in the treatment of fractures is unsatisfactory or when a poor functional result seems imminent, the patient and his relatives (and frequently his lawyers) scrutinize and criticize the physician's work. Nowadays the radiographs, which seem to be the most essential factor in the management of fractures, are read and passed upon by the laity. It is therefore incumbent upon the physician to employ the method of modern treatment which, in his best judgment, will yield the best result under the conditions at hand.

The term "acute fractures of the hip" usually brings to mind that bête noire of all fractures—the intracapsular fracture—and a brief consideration of the various methods now available for treatment of these fractures should be of value.

Closed Methods

1. The oldest and best known of the closed methods of treating intracapsular fractures of the hip is by simple adhesive traction. While this form of treatment remains the method of choice in a few cases, the weight of modern opinion is steadily narrowing the field of its application. Occasionally the surgeon *must* ignore the fracture and treat the infirmities of age, but this is rarely necessary. The Buck's extension method is painful, exhaustive, and crippling.[4] Very few patients are too feeble to stand a cast, and one is often surprised at the comfort these frail, feeble patients find in a properly applied cast.

2. The Carl Jones traction device has many supporters because it allows the patient to sit up at will. The merits claimed for it are simplicity of application and painless reduction. This appliance employs the Hoke principle of counter traction exerted against the sole of the sound foot. The dorsum of the foot and the malleoli of the injured side carry the burden of the traction, which is exerted powerfully by a screw. The splint was originally designed as a temporary transportation splint, and it serves admirably for this purpose. Considerable skill in handling plaster is necessary for its successful application, for if the casts are heavily padded they slip and produce pressure sores in spite of the padding. The successful use of this splint depends upon a well fitting cast and upon partial release of the traction after the fracture is evidently reduced. My patients objected to the position of the extremities and complained of strain in the knees.

3. The "Roger Anderson Well Leg Counter Traction Splint" has been widely offered to the profession for treatment of these cases. By skeletal traction this splint powerfully applies the principles of Hoke traction. Although this splint exerts traction more efficiently than the Carl Jones device, it does employ skeletal traction which requires strict aseptic technic, and on this account its application is more limited.

4. The Whitman abduction method has almost become routine in the treatment of intracapsular fractures of the hip. In this method traction is applied to both lower extremities on a fracture table, as is well known. Less well known are the important steps of lifting the upper thigh forward and pulling it slightly laterally before rotating the extremity inward. This maneuver disentangles the fragments. Abduction is the *last* step and does not reduce the fracture but holds the fragments in position. With the advent of lateral x-rays of the hip we now recognize that many of these fractures are not completely reduced. They must be reduced before the abduction cast is applied.

5. Thomson's modification of the Whitman cast maintains abduction more efficiently. In this method the thigh on the sound side is abducted and included in plaster to the knee. If such a double spica cast is properly applied and reinforced with the strut, the lower chest need not be included but only the iliac crests, which allows the patient to sit up part way.

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6. Cotton's Artificial Impaction adds still more to the Whitman-Thomson method, but probably should not be employed until the surgeon is reasonably certain that the fracture is reduced.

7. Leadbetter's Method[5] is the most efficient of the closed methods available today and should be more widely used. It is similar to Gaenslen's method and really reduces the fracture. The steps of the manipulation are as follows:

"The pelvis is fixed on a fracture table by an assistant and under moderate manual traction (with the knee flexed) the hip is slowly flexed to 90 degrees, then the slightly adducted thigh is lifted directly upward (*i.e.*, vertically, to correct posterior displacement and shortening), then gently rotated inward 45 degrees to engage the fragments. During this maneuver an assistant pulls the thigh laterally to clear the inner fragment and line up the two fragments by tension on the capsule.

"When the fragments are felt to be engaged, the hip should be circumducted into abduction and extension and the opposite thigh should be fully abducted."

A fractured hip successfully reduced by any method should fulfill Leadbetter's requirements for reduction:

"1. Full abduction (equal to the sound side) can be obtained and maintained without undue force.

"2. The hip should be *stable as regards length* in a position of full abduction, *i.e.*, no traction necessary to prevent recurrence of shortening.

"3. In a position of full abduction the hip should be stable as regards rotation." This is the crucial test, and Leadbetter insists that a hip is not completely reduced which does not maintain its position supported on the open palm. Leadbetter's "palm test" should be applied to every case after manipulation.

As our knowledge of the pathology of these cases improves, and we study them in two planes by lateral x-rays, we realize that many cases which we formerly considered to be perfectly reduced were really inadequately reduced. Most cases of non-union are due to incomplete reduction and many are due to failure to maintain the reduction. However, there are still some cases of non-union in which reduction was complete and was efficiently maintained throughout the normal healing period. Because closed methods fail in such cases there is a definitely increasing inclination toward open surgical attack. While it seems unlikely that open operative methods will ever come into general use, the improved results reported to date indicate that capable surgeons are undertaking operative procedures more frequently.

Open Methods

1. Albee recommended his tibial bone graft for these cases in 1913. His operation is excellent but requires three incisions and unusual operative skill. The operation, perhaps, had best be reserved for cases of delayed or non-union.

2. Smith-Petersen[7] devised a three flanged nail to secure impaction and internal immobilization in these cases. In his series bony union was secured in 86 per cent of the cases—a distinct improvement over the results usually obtained by closed methods. The operation requires considerable operative skill, but Westcott[8] has devised a protractor to simplify accurate introduction of the nail. Henderson, too, has introduced the nail more accurately along a Kirschner wire as a guide.

3. Magnuson's operation[6] of reaming out the distal side of the head and freshening the neck of the femur seems better suited to cases of delayed or non-union.

4. In the same category is Bozsan's[1] operation of drilling into both sides of the exposed fracture to re-establish increased circulation.

5. Hey-Groves of Bristol, England, reported a means of "proximal pegging" in 1929.

6. Ellis Jones[3] devised a trochanteric graft for these cases. His exposure overcomes many objections to the blind pegging type of operation.

7. A rustless steel screw-bolt has been devised by the author[2] to secure and maintain reduction in these cases. It is introduced from the trochanteric side to hold the head of the neck and can be removed easily if desired.

Method of Choice

Operative methods should, of course, be reserved for patients who are good operative risks and should be employed only by capable surgeons in well equipped orthopedic operating rooms. The average conservative surgeon will probably do best to perfect his application of the Whitman or Leadbetter method. After he has reduced the fracture carefully and before he has

applied his cast, the surgeon should have x-rays —both antero-posterior and lateral views. Satisfactory lateral views can be made with the average portable x-ray outfit. If the reduction is not complete and satisfactory, certainly a second attempt should be made to make it so. Usually there is no real reason why a second attempt should not be made to obtain a perfect reduction.

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TREATMENT OF NON-UNION FRACTURE OF THE HIP*

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THE time allotted to a discussion of this phase of our symposium precludes any detailed discussion of cases or lengthy analysis of the factors causing non-union.

We have just heard an excellent presentation of the closed method of caring for the fresh fracture of the neck of the femur.

Many of you know that I have long championed the Whitman method of abduction, internal rotation fixation of the fresh fracture and have taken exception to the criticisms directed against the method because I felt that an analysis of end-results in that treatment should be predicated upon a properly proven initial reduction. No one would report a series of one hundred cases of Pott's fracture and advocate a method of reduction if 40 per cent of the reductions were inadequate. Yet I have seen case after case of fractured neck of the femur supposedly treated by Whitman's method in which the lesser trochanter was not lost to view by the internal rotation. The method receives the blame when the stigma should be on the operator's faulty application of the method.

We now have a method of proving this contention—the curved cassette as used by George and Leonard of Boston, which gives us the all-important lateral view of our reduction. Their series is the actual proof. Forty consecutive cases, proven by antero-posterior and lateral post-reduction views to be correctly reduced, gave thirty-eight unions and only two non-unions, in which two some question as to the careful postoperative retention of position arose. The series is small but one conclusion may, I believe, be safely drawn: with proper reduction, and proven reduction, non-union in the hip should fall well under 10 per cent as compared to the old 40 to 60 per cent.

This method of check also gives us an opportunity to discover those obviously unreducible fractures in which we should be able to early determine the indications for open reduction—let us say within a week. Such open reduction should then utilize a fixation peg of bone graft or a metal nail of the Smith Peterson type or the Henry screw.

Given a case of obvious non-union certain fundamentals must be considered before determining our course. Does the patient's age preclude active treatment? Has the patient pain or is it obvious that he will develop pain? If so, a well fitting Thomas ring caliper may give him stability enough to get along well until a short or at least tough fibrous union permits a fair degree of function with comfort.

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Every case of non-union is an entity which needs individual study as to the proper procedure. The essential disability is painful instability. The essential of treatment desired is painless stability. This instability is due to loss of the fulcrum of weight bearing at the hip and may be increased by the tangential strain upon the fracture line.

The simplest surgical procedure to correct this is the low Schantz osteotomy which has been long advocated in Continental clinics and more recently by Gaenseln of Milwaukee. Abduction and apparent length is obtained, stable weight bearing against the pelvis is secured and occasionally union occurs by reason of the loss of tangential strain at the fracture line.

The procedure carries little risk, a morbidity of about four months and early weight bearing is allowed with protecting caliper or short hip spica. Occasional non-union has been known to occur at the osteotomy site.

Given a viable head, one should consider the Brackett operation, which is essentially the freshening of the fracture surfaces with interposition of the remodelled neck and great trochanter into the scooped out head. This procedure should be used early, prior, of course, to the death of the head. The morbidity of this procedure is prolonged until union occurs and carefully protected weight bearing for a considerable time thereafter is essential. The production of a short neck by the operative procedure may result in some troublesome shortening and loss of ranges of motion due to mechanical limitation.

With the exception of those cases in which the physical condition of the patient or the existence of a not too troublesome fibrous union precludes operation and those cases in which Schantz osteotomy is indicated I have had the best results from the Whitman reconstruction operation.

This procedure removes the head, often not viable, transposes the great trochanter with its muscles attached down the shaft for new purchase power and remodels the stump of the neck so that a marked disproportion between remodeled stump and acetabulum precludes ankylosis. A fascial flap may or may not be turned over the raw surface of the neck, as Kleinberg suggests, though I have found this necessary in only one case.

The morbidity in hospital is less than six weeks. Weight bearing is begun early at two to three weeks with protective spica. Stability is assured. Painless weight bearing results in from three to six months and a surprising amount of mobility is present in the majority of coses.

Conclusions

1. The best preventive of non-union is proper proven reduction.
2. Non-union should not then be so frequent as formerly.
3. Open reduction *per se* should be done early when indicated.
4. Protective weight bearing by Thomas ring caliper is desirable in the feeble and aged.
5. Stability is the aim of operative treatment.
6. The Schantz osteotomy is a conservative operative treatment which gives excellent results.
7. The Whitman reconstruction operation is a major operative procedure which best satisfies the criteria of a good result.

FRACTURES OF THE SHAFT OF THE TIBIA AND FIBULA*

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FRACTURES of the shaft of the tibia and fibula may be simple and without appreciable displacement. Such fractures are easy to treat and require only to be splinted by means of a cast until they heal. There are some points of importance in their management. X-rays should include the entire leg, as low fractures of the tibia are often associated with a break in the upper end of the fibula. In all fractures above the lower third of the leg it is best to include the knee in the plaster. In older people, if a window is cut over the knee and the patella is actively and passively moved daily, stiffness of the knee is largely prevented. A U-shaped "walking iron"

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of the Boehler type is incorporated in the cast, projecting not more than three-quarters of an inch below the heel, and the foot is held at right angles. With transverse fractures, walking without crutches can be started within a week. In oblique fractures, full weight bearing had best be delayed for a month. The position of the fragments should be checked by x-ray in two weeks and in a month, as slipping of the fragments within the cast can occur. In children, the cast may be removed in six or eight weeks, and usually no further support is necessary. In adults, firm union requires from two and one-half to four months or longer. The amount and quality of callus as shown by x-rays is the best criterion in determining the time for removal of support. In case of doubt, it is well to reapply a light cast extending to the knee, or to fit the patient with a caliper brace with a long fitted cuff support. Swelling of the ankle following removal of the cast is minimized by generous adhesive strapping. If early weight bearing has been instituted, stiffness and swelling of the ankle is not marked. Full functional recovery should be the rule in from four to six months in an adult.

Displaced fractures of the shafts of the tibia and fibula offer a real problem of treatment. They are often comminuted and not infrequently compounded. Nerve and vessel injury may occur. Shock is not infrequent.

Reduction is made very much easier if the fracture is splinted and temporary traction applied at the place of accident, and if the reduction is completed at the earliest possible moment. After several days have elapsed reduction is much more difficult.

Many forms of treatment are advocated, from simple manipulative reduction and application of a cast, to open reduction and internal splinting. The intelligent use of skeletal traction methods has made these fractures much less formidable, and probably is the method of choice in the majority of cases.

Transverse fractures, particularly in children, can often be reduced by simple manipulation and traction. Under general or spinal anesthesia, the patient is placed on the Hawley fracture table, and a traction cuff of muslin bandage is looped about the ankle over thick felt pads. Screw traction is applied, the shortening overcome, and the fracture manipulated manually until reduced. The reduction is checked by portable x-ray, and a cast is applied from above the knee to the ankle. This is allowed to harden. The traction is removed, and the cast extended to include the foot, care being taken to keep the foot at right angles. Another x-ray is taken, and if the position has been maintained a walking iron can be applied.

The oblique or comminuted fracture can seldom be kept in good position by such means. It is in these types that skeletal traction or distraction methods are efficient. Skeletal traction is not difficult to apply. With rigid asepsis, infection practically does not occur. Except in an emergency, its use should be limited to a hospital, and preferably to the operating room. Once the pins or wires have been aseptically and satisfactorily placed, the secret of avoiding infection and drainage is to leave the dressings strictly alone, and to carefully avoid all lateral movement of the pin. A general or spinal anesthetic simplifies the procedure. With the patient on the Hawley table, the leg is shaved and prepared as for any surgical procedure. Using a jointed Steinman pin and the handle provided, a pin is driven exactly through the center portion of the os calcis, avoiding the important structures posteriorly and below the malleoli. The pin should be placed straight and at right angles to the bone; this is the only difficult part of the procedure. Another pin is placed transversely through the upper crest of the tibia, just below the spine. This need not be deeply placed. Dressings soaked in tincture of merthiolate or mercurochrome are pulled over the pin ends to cover the puncture wounds closely. The traction bow is applied to the lower pin and attached to the traction foot plate. With the perineal counter-traction post in place, and the opposite foot fixed in its traction stirrup, slow screw traction is applied until the leg is taut and measurement shows the length of the two legs to be the same. It is wise to overcorrect the fragments a little as, when this is done, reduction is often spontaneous. Side-to-side compression of the fracture site will effect a reduction. An x-ray is now taken in two planes, and while waiting for this to be developed, the application of the cast can be started, leaving the fracture site exposed until the films are seen. If the fracture is over-corrected, traction is reduced a corresponding amount, so that

bone-to-bone approximation is obtained. This is important, as non-union will often result if the over-correction is allowed to remain. The cast is now completed, incorporating both pins snugly. In all fractures except those low near the ankle, the cast should extend above the knee. A window is cut over the patella, and when the cast is hard, the traction is discontinued. A check-up x-ray is taken for record. The patient is put to bed with the foot elevated on pillows. The toes are watched closely for signs of circulatory disturbance. At the time the cast is applied, it is best to split it up one side, so that it may be easily loosened if necessary. After forty-eight hours, when it is established that there is no pressure or circulatory disturbance, the patient is allowed up on crutches. In four or five weeks, the pins are removed and a new cast applied with a walking iron incorporated. Weight bearing is then continuous until the cast is removed at the end of three months. If callus is satisfactory, no further support is necessary. If there is any question as to the stability of the fracture, it is best to have a caliper brace fitted.

There is no question that reduction is made more easy if traction is applied with the knee at right angles. For this purpose various frames have been devised, among them those of Boehler, Watson Jones, and Martin. Martin's apparatus is simple and can readily be made. I am advocating the Hawley or other fracture table, since it is found in nearly all hospitals, and because the technic is simple. The results are very good.

When fractures are seen unreduced after an interval of several days, there is some danger of damage to soft parts if a rapid reduction is done on the fracture table. In these cases it is often best to place a Steinman pin or a Kirschner wire through the os calcis, and apply traction on a Braun or Boehler frame. The foot of the bed is raised to provide counter-traction, and from 15 to 40 pounds of weight will be required to effect reduction. When the fracture is reduced, the amount of weight is cut down so as not to over-correct. After a month of traction, a cast can be applied. While the leg is on the frame, pressure sores are prone to develop under the knee and over the achilles tendon, and these must be guarded against by proper care and padding. To prevent anterior bowing at the fracture site, the calf must be allowed to sink to its normal contour. The traction apparatus must be readjusted several times daily if it is to be kept efficient.

Compound fractures in this region are common. They usually consist of puncture wounds by sharp fragment ends, but are sometimes extensive. By opening up the puncture, and irrigating the wound thoroughly with saline, and with an antiseptic such as tincture of merthiolate, primary closure and rapid healing is the rule. More extensive wounds require a thorough removal of foreign material and badly injured tissue. Irrigation to cleanse the wound will promote uneventful healing. Orr's method of packing the wound with vaseline gauze gives good results. In all compounded fractures the routine use of tetanus and gas bacillus antitoxin is advocated. Should gas bacillus infection develop, it is much less virulent if antitoxin has been given prophylactically.

With satisfactory skeletal traction, the need for open reduction is markedly reduced. There will be an occasional case, particularly of the spiral type of fracture, where interposition of soft tissue prevents reduction, which will have to be reduced openly.

Swelling and the formation of blisters do not contraindicate immediate reduction and the application of a cast. If the blisters are opened aseptically, and a protective dressing applied, they will heal readily under a cast. If the fracture is reduced early and a cast applied, they will usually not form. The best prophylaxis for the avoidance of all complications is immediate reduction of the fresh fracture.

INTRA-ARTICULAR FRACTURES OF THE ANKLE RESULTING FROM INDIRECT VIOLENCE*

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INTRA-ARTICULAR fractures of the ankle resulting from indirect violence are very common in active adult individuals but are uncommon injuries in children. They are major problems, since considerable disability may follow delayed and inadequate treatment. The object of this brief paper is to review certain anatomical, physiological and surgical principles upon which the therapy of this group of fractures is based.

The names of Pott, Dupuytren and Cotton are prominent in the history and description of fractures of the ankle. Their names are inseparably related to many of the various classifications of ankle joint injuries. Modern classifications are based on the mechanism of production of the fracture and the pathological anatomy resulting from the injury. The one by Ashhurst and Bromer[1] increased materially our understanding of the mechanics involved in the production of fractures about the ankle. Key and Conwell present an anatomical outline for the purpose of treatment in their recent text, Fractures, Dislocations, and Sprains.

The surgeon who attempts to treat ankle joint fractures must have a thorough understanding of the following two subjects: (1) the normal and pathological anatomy and physiology of the ankle joint mortise; (2) the functional treatment of fractures. The principles involved in the first subject have been emphasized by Skinner[4] and those included in the second subject are the well-known but too infrequently applied teachings of Böhler.[2]

The fork-like mortise of the ankle joint is formed by the articular end of the tibia, above; the internal malleolus, medially; and the external malleolus or distal end of the fibula, laterally. For the purpose of description of ankle fractures the anterior and posterior margins or lips of the mortise are referred to as the anterior and posterior malleoli, respectively. The mortise embraces and articulates with the body of the astragalus. The anchorage of the astralagus within the mortise is extremely secure by virtue of the strong medial and lateral ligamentous attachments. Normally, there is no lateral movement of the astragalus within the mortise. Flexion and extension are the normal movements of the ankle joint while lateral motions are functions of the subastragalar and calcaneo-cuboid articulations. The astragalus is an important and interesting bone. Its body is the keystone of the foot. No tendons are attached to it and it is the only tarsal bone which transmits the entire body weight. It is also the only tarsal bone which is in direct anatomical relationship with hind-foot, fore-foot and leg. It enters into the formation of the most important joints of the foot, the tibio-tarsal or ankle joint and the subastragalar joint which includes the calcaneo-astragaloid and calcaneo-astragalo-scaphoid articulations. The body weight is directed in two directions from the astragalus, downward and backward through the hind-foot, and, downward and forward through the fore-foot.

A continuation of the mid-longitudinal axis of the shaft of the tibia normally bisects the body of the astragalus in both the antero-posterior and the lateral planes (Fig. 1). This anatomical fact is translated into a physiological or functional expression as "the normal weight bearing lines" which are disturbed by all intra-articular fractures of the ankle with displacement of the fragments. A lateral radiogram reveals that the contour of the articular surface of the body of the astragalus is convex while the antero-posterior view demonstrates a concave outline into which fits the convex articular surface of the tibia. A continuation of the mid-longitudinal axis of the shaft of the tibia normally passes through the apex of the convex surface of the tibia and through the center of the depth of the concave outline of the articular surface of the astragalus (Fig. 1). This anatomical and roentgenological relationship is lost in all ankle fractures with displacement but is restored with perfect functional reduction.

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Every fracture of the ankle with displacement of either the internal or external malleolus is in fact a dislocation of the astragalus in relation to the mortise of the ankle joint. The malleolus which is fractured and displaced is in normal relation with the astragalus while the malleolus which is intact has been separated from the astragalus by a rupture of the corresponding lateral ligament. The fractured and displaced malleolus is firmly attached to the astragalus and the astragalus is in normal relation with the foot; therefore, the foot serves as a lever by which the position of the astragalus and fractured malleolus may be controlled and restored to the normal.

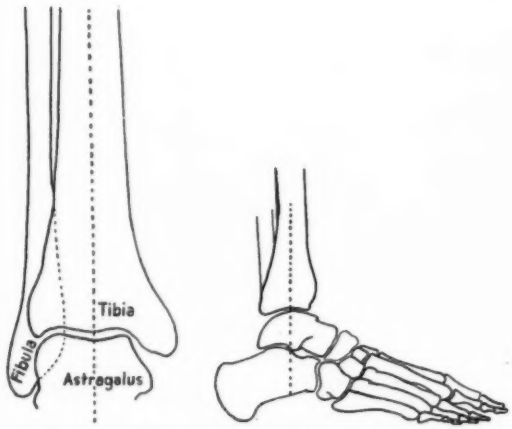

Fig. 1. A continuation of the mid-longitudinal axis of the shaft of the tibia normally bisects the body of the astragalus in both the antero-posterior and lateral planes.

A classification of ankle joint fractures with displacement, for the purpose of treatment, should emphasize the type of dislocation of the astragalus in relation to the mortise of the ankle joint, as well as the displacement of the foot in relation to the normal weight bearing lines or mid-longitudinal axis of the shaft of the tibia. The maneuvers of any manipulative reduction are attempts to reduce the dislocated astragalus and to reëstablish the weight bearing lines. If, following reduction, radiographic studies reveal that the mid-longitudinal axis of the shaft of the tibia does not bisect the body of the astragalus, then the manipulation has failed and should be repeated. The surgeon's attention should not be confined to the alignment of the fractured fragments. Although their position may appear satisfactory in the post-manipulative radiograms, manipulative reduction should be attempted again if the normal weight bearing lines have not been restored.

The dislocation of the body of the astragalus from the mortise of the ankle may be anterior, posterior, medial, lateral, upward or rotational.

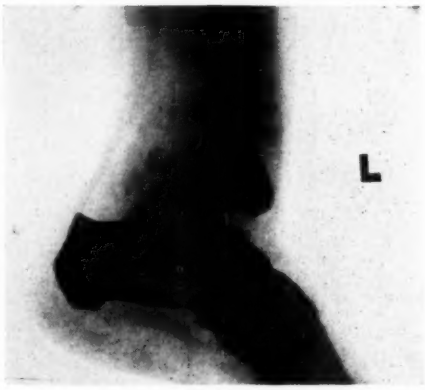

Fig. 2. Trimalleolar fracture (internal and external malleoli and posterior tibial margin) with posterior dislocation of the astragalus in relation to the ankle mortise.

Various combinations of the above displacements may occur. Since the rationale of manipulative reduction is based upon the exact type of dislocation of the astragalus it is obvious then that the relation of the body of the astragalus to the mid-longitudinal axis of the shaft of the tibia in both antero-posterior and lateral planes must be accurately determined by proper radiographic studies before the reduction is performed.

The fracture may involve one or more of the four margins of the ankle joint mortise—the internal, external, posterior or anterior. Isolated malleolar, bimalleolar and trimalleolar fractures with displacement of the fragments should always be studied and treated as dislocations of the astragalus. The methods of reduction advocated by the writer are based on the principle of functional reduction of the dislocation of the astragalus and restoration of the normal weight bearing lines. Anatomical reduction of the malleolar fragments is not infrequently achieved with the functional reduction of the dislocation. However, if satisfactory functional reduction of the dislocation is not combined with anatomical reduction of the fragments it does not follow that open operation should be done in order to gain anatomical position of the fractured malleoli.

Intra-articular fractures of the ankle with malleolar displacement should be treated by manipulative reduction based on the principle of functional reduction and not necessarily on the principle of perfect anatomical reduction.

As a rule the injury is not complicated by shock. Reduction should be done immediately before hemorrhage, swelling and edema have developed. During transportation of the patient to the hospital the foot, ankle and leg should be well supported by an emergency splint such as a pillow splint, wire basket or Cabot posterior wire splint. Constricting bandages should be avoided. Antero-posterior and lateral radiograms are studied to determine the extent of the injuries to the mortise of the ankle and its content, the astragalus. The reduction is done with anesthesia, either local, spinal or general, according to the preference of the surgeon.

The maneuvers of any reduction entirely depend upon the type and extent of the astragalar dislocation. Trimalleolar fracture with posterior and lateral dislocation may present a difficult problem for reduction to many surgeons (Fig. 2). The following method is used by the writer (Fig. 3a, b, c).[10] The posterior displacement is corrected by manual traction with the fore-foot in one hand and the heel in the other while counter traction is provided by a padded muslin bandage which is fixed to the plaster or operating table and surrounds the lower third of the leg with the knee flexed (Fig. 3a). The lateral displacement is reduced by medial traction and inversion maneuvers while the longitudinal traction on the foot is continued by an assistant. The fractured malleoli should be squeezed into their normal positions so that they will firmly grasp the body of the astragalus.

The final position of the foot should not be in eversion or inversion but neutral as to lateral position and at a right angle in relation to the leg. Edema may be partially eliminated by digital pressure. Stockinette or one layer of sheet wadding is applied next to the skin. The heel and bony prominences are protected with felt. A light and well-molded plaster-of-Paris cast is applied, incorporating the foot, ankle and lower one-third of the leg. The longitudinal traction is continued until the cast has hardened (Fig. 3b).

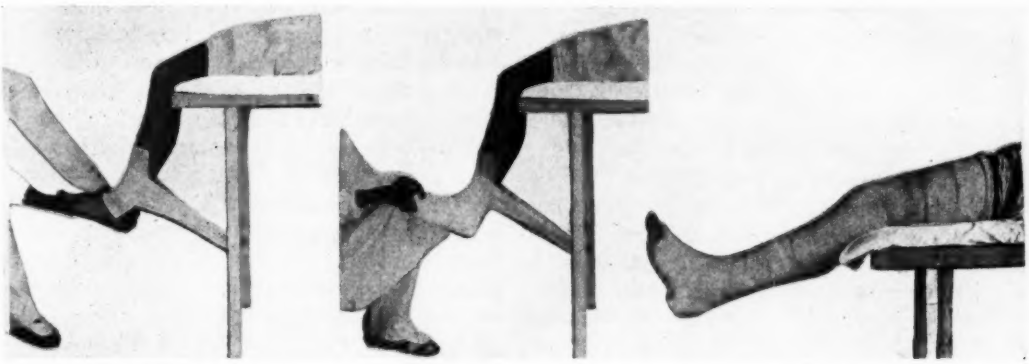

Fig. 3a. Fig. 3b. Fig. 3c.

Radiograms are now taken and studied. If the reduction is perfect then the counter traction bandage is released and the cast is continued to mid-thigh with the knee in slight flexion (Fig. 3c). A plaster heel consisting of a firm roll of sheet wadding covered by several layers of plaster is applied to the cast instead of an iron stirrup. The plaster heel should be level and flat and in direct line with the leg (Fig. 3c). It should be of a thickness which will just remove the fore-foot from contact with the floor when the patient becomes ambulatory. It is rarely necessary to bivalve or cut the cast longitudinally because of circulatory complications if the extremity is properly and immediately elevated with the foot higher than the knee and the knee above the heart level. The cast should not be covered with bed clothing until it has thoroughly dried. The patient is instructed to contract actively and frequently the flexor and extensor muscles controlling the toes since muscular contractions favorably influence the circulatory system. Heat ap-

plied to the ankle by means of hot water bottles, electric pads or electric bulbs may aid in the control of pain.

After a period of about one week, when the inflammatory reaction from the injury has subsided, the patient becomes ambulatory with crutches and with partial weight bearing directly on the injured extremity. The portion of the cast above the knee is now removed. If the cast enclosing the foot and ankle is loose because of considerable edema, originally, then a new one is applied. At this point in the procedure many surgeons meet with difficulties because the patient complains of pain and swelling of the foot when weight bearing.[11] If the surgeon gives the patient the following program and if it is followed religiously then the patient and surgeon will both be relieved of the distressing problems of pain and swelling.

PROGRAM FOR PATIENT TO BECOME AMBULATORY

Day	Elevation Minutes each Hour	Weight Bearing Minutes each hour
1st	59	1
2nd	58	2
3rd	57	3
4th	56	4
5th	55	5
6th	50	10
7th	40	20
8th	30	30
9th	20	40

Following the tenth day the patient may be ambulatory much of the time with several half-hour or one-hour periods of elevation. The patient should now be contracting the muscles which control the ankle joint in order to maintain muscle tone and to aid circulation. After several weeks the patient may walk with one crutch and then gradually change to the use of a cane. After a period of about two months the cast is removed. The degree of painless and active motions that are possible in the ankle joint are usually very surprising and encouraging. The ankle may be strapped with adhesive or a short single or double upright brace may be applied in order to protect the ankle from subsequent strain or injury. Hot foot and leg baths or contrast baths several times daily with active muscular contractions and joint motions in all directions are valuable in aiding the complete restoration of the neuro-vascular-muscular and articular mechanisms.

Partial permanent disability, post-traumatic circulatory edema, deformity, and traumatic arthritis of the ankle joint will infrequently complicate the therapeutic program for the treatment of intra-articular fractures of the ankle if the principles of "Functional Reduction" as emphasized by Skinner and the principles of "Functional Treatment" as expressed by Böhler are applied by the medical profession.

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THE BROKEN NOSE*

Some Simple Rules for the Management of Recent Fractures of the Nasal Bones in General Practice

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WE all see many instances of nasal deformity which frequently engender not only social problems, but economic problems as well, not to mention the physical disturbances due to the intranasal abnormalities which so often follow nasal fractures. Most of these cases could be relieved or cured by intelligent manipulation immediately after the trauma. Unfortunately, many of them are neglected, particularly in early childhood, and especially in remote communities where the services of a rhinologist are not obtainable.

In such communities, if the man who sees these cases first, that is, the general practitioner, were properly trained, some of the simple cases could be taken care of by him at once.

Most recent nasal fractures fall into one of two groups, namely, the median type, in which the blow was struck more or less in the midline, that is, from directly in front, and the lateral type, in which the blow was struck from one side or the other.

In the median type, the nasal bones are fractured and depressed approximately equally. Frequently the fracture flattens the nasal bridge and at the same time breaks laterally the adjacent portion of the maxillary bones. In these cases we feel a very definite ridge at each side of the nose. In other cases the lower ends of both nasal bones are broken and displaced posteriorly without involvement of the upper part of the bridge.

In the lateral type, we find a depression of the nasal bone and possibly of the adjacent part of the maxillary bone on the side where the blow was struck, whereas the opposite bone will be displaced toward the other side. In these cases it is obvious folly to attempt to push inward the opposite bone until the depressed bone or bones are first elevated and correctly replaced.

The nasal bones are two quadrilateral—not triangular—bones at the bridge of the nose. These articulate above with the frontal bone, medially with each other, laterally with the nasal processes of the maxillæ and below with the upper lateral cartilage. Preston states appropriately that the bones meet in the median line and rest upon the spine of the frontal somewhat as the rafters of a roof rest upon the king-beam. The nasal spine itself is supported posteriorly by the vertical plate of the ethmoid and this continuity of bone from the bridge to the crista galli explains why a blow on the nose can force the perpendicular or the cribriform plate of the ethmoid up into the anterior cranial fossa. This becomes more true with increasing age since the articulations become so firmly ossified as to constitute one solid mass of bone, transmitting, at times, the force of a blow from one end to the other. Below the upper lateral cartilage is the lower, on each side, as well as a number of small sesamoid cartilages, all bound together by connective tissue and subject to movement by the muscles which contract or dilate the nasal introitus.

The septum is formed principally by the cartilage, the vertical plate of the ethmoid and the vomer. The crests of the maxilla, palate and nasal bones and the nasal spines of the frontal and maxilla also enter a little into the formation of the septum, but for present purposes these may be disregarded. It must not be thought that nasal trauma is always the cause of septal deviations. These are found very often in patients who have no history of any injury whatsoever, and are explained by improper development of the facial and nasal bones. For instance a child with a high, peaked palatal arch due to the presence of adenoids or to some other cause has a condition in which the nasal floor is crowded up against the nasal ceiling, bending or dislocating some parts of the septum in the process. Such deformities are very common, and, in fact, are often of no clinical importance, but an injury to the nose may cause marked exaggeration of such a mild deformity.

*Presented before the annual meeting of the Minnesota State Medical Association, Duluth, July 16, 1934.

Almost all fractures of the nasal bones are compound, that is, they are open through the skin or the mucous membrane or both. Usually the septal cartilage is involved more or less.

In a lateral fracture the depressed bone is often driven posteriorly beneath the nasal process of the frontal bone, and is there impacted. It may also have been pushed beneath the nasal process of the maxilla. The opposite nasal bone is also separated from its attachments, but usually it *overlies* the adjacent bony structures. Very frequently a considerable portion of the nasal process of the maxilla is broken off, along with the nasal bone, being depressed on the primary side and pushed outward on the opposite side. In lateral fractures of considerable degree, the depressed nasal bone acts as a splint against the opposite one, holding the latter out somewhat as the back prop of an easel holds the frame forward. Many ill-advised, even vicious, efforts have been made to force the protruding nasal bone medially without first lifting the depressed bone laterally and anteriorly. Such efforts not only produce no improvement, but result in further trauma. Of the coexisting fractures in adjacent bones, the most dangerous is that in the cribriform plate of the ethmoids.

General Management of All Types of Recent Nasal Fractures

1. *History of injury:*
   a. When and where.
   b. What was the nature and force of the traumatizing object—a blunt or sharp object, a fall, a swinging door, etc. From this we may form some opinion as to the depth of the wound and extent of injury, including the possibility of a coexisting basal skull fracture, or of intracranial complications.
   c. Ascertain whether or not the patient's nose was perfectly straight before the injury. He may be a malingerer who is trying to build up a lawsuit. Try to get a recent photograph of the patient, prior to the injury; the deformity may have been incurred, in part or in whole, many years ago. In fact, the patient may honestly be unaware of a pre-existing deformity, the matter being brought to his attention by the present injury. Some persons, especially athletes, suffer repeated nasal fractures. I have just seen a boy whose nose has been broken three times, once at football, a second time at basketball and the third time at boxing. This patient volunteered the information that the second and third fractures did not appreciably alter his appearance. From a medicolegal standpoint, therefore, it is well to establish the presence or absence of nasal deformity and obstruction, and even the condition of the sense of smell, prior to the injury.
2. *Symptoms:*
   a. Pain—usually not marked.
   b. Nasal obstruction—which side and how much; usually it is marked.
   c. Evidences of cerebral involvement, due to concussion, skull fracture, hemorrhage, or the driving of bones upward and backward into the anterior cranial fossa, leading to brain abscess or meningitis.
   d. Lacrymation, when the nasolacrymal duct is involved by a fracture of the maxilla.
3. *Physical Signs:*
   a. Swelling of the nasal and adjoining tissues, external and internal.
   b. Contusions, abrasions and lacerations—superficial or deep.
   c. Ecchymosis or other discoloration of the skin or conjunctiva.
   d. Large bullæ and vesicles in the traumatized area. These are common in or near any fracture zone, and are transitory, though they may resemble pemphigus.
   e. Lacerations of the nasal mucous membrane, with hemorrhage. This makes the case a compound fracture, but it is astonishing to find how rarely bony infection develops through these channels. Hemorrhage from within the nose is usually prima facie evidence that there has been a separation or fracture severe enough to cut the nasal mucosa.
   f. Tenderness on even gentle pressure is often marked.
   g. Emphysema: Some of the text-books give the impression that this symptom is definite evidence of involvement of one of the nasal sinuses in the fracture. This is not so, since blowing the nose may force air beneath the skin through a tear in the mucosa. However, the sinuses.

both frontal and maxillary are often involved if the corresponding bones are fractured.

h. Crepitation—grating or clicking of the bony fragments upon pressure—is often felt. Its absence by no means signifies that a break is not present.

i. Excessive mobility of the nasal bridge.

j. External deformity depends upon whether the case is a lateral or a median fracture. When the blow was struck from the right or the left, there is a sinking in of the nasal bridge on the primary side and a pushing out on the opposite side. The nasal bridge or the entire nose is bent toward the opposite side. The nasal contour may be gently bowed or sharply angulated. In a median fracture, if the blow was not very severe, only the lower ends of both nasal bones will be found to have been fractured, tranversely. If such a fracture was due to a more severe blow, the nasal bones are broken, transversely, higher up, at or near their articulation with the frontal bone. They are flattened down also, since the center of the nasal bridge is driven posteriorly, forcing the lateral edges outward. This also makes the bridge much wider. Very often the fracture does not take place at the suture line at all, but in the nasal process of the maxillary or frontal bones, since the articulations here are very firm. As a result, a sharp ridge is felt at one or both sides of the nasal bridge. When the upper lateral cartilages are torn away from the nasal bones, the ala nasi are markedly depressed, flattened and widened.

k. Intranasal deformity includes:

I. Deviation or dislocation of the septum.

II. Hematoma, usually of the septum.

III. Obstruction of the air space on one or both sides.

Septal deformities are very common, and may be gently bowing, or sharply angulated deformities (which later develop so-called "spurs") toward one side, the concave side being deeply grooved. This deformity may be most marked at the anterior end of the septum (in the cartilage), or at the junction of the cartilage with the maxilla near the nasal floor, or at the articulation of the cartilage with the ethmoid or most commonly at its junction with the vomer.

4. *Diagnosis:* From the history, symptoms and signs it should be very easy to make a diagnosis. X-ray plates are often, but not always, essential.

5. *Complications:* Most of these have already been mentioned. Intracranial complications are frequent and dangerous. Fracture into a sinus may lead to inflammation here, but it rarely does. Local infection in the nose is not uncommon. Softening or necrosis of bone or cartilage may develop following hematoma or suppuration, with contraction of the affected tissues and secondary deformity. Osteomyelitis, chondritis, erysipelas, cellulitis, periostitis or perichondritis may be late complications. A patient with a hematoma over a cartilaginous area should always be warned that the cartilage may soften, shrink and be twisted into an unnatural shape eventually even despite drainage.

6. *Prognosis:* The outlook so far as life is concerned, is very good unless there is a deeper fracture of the skull. From the standpoint of the deformity, in promptly and properly treated uncomplicated cases, the prognosis is good. When the trauma is severe and the comminution marked, it may not be possible to replace or hold in position all the small bony fragments, and for this reason the prognosis should be guarded in such cases.

7. *Treatment:* The method of reducing a simple fracture of the nasal and adjoining bones is one of the most universally accepted, time-tried and efficient procedures in surgery.

If the history warrants it, as in the case of an automobile injury or trauma sustained in a farm yard, the advisability of administering tetanus antitoxin must be kept in mind always.

a. Anesthesia: Occasionally local anesthesia may suffice. If so, cocain in 10 or 20 per cent solution, or even in powder form, must be applied to the anterior ethmoidal nerve, on the posterior surface of the nasal bridge. In the great majority of cases, however, the best results will be secured on using general anesthesia,—nitrous oxide, ethylene or ether. If local is used, the patient always feels some part of the manipulation and the surgeon may hesitate to use the requisite amount of force in completing the reduction.

b. Place a cotton applicator saturated with

epinephrin high up behind the nasal bridge, before beginning the reduction. There is usually considerable bleeding even so; therefore it is well to have some sort of suction in the pharynx during the manipulation.

c. We next proceed to thorough cleansing of the skin with soap and water, and the removal of all dirt, foreign bodies, and loose fragments of bone. Alcohol, iodine, mercurochrome (aqueous) or any other satisfactory germicide must be used.

d. Remove all necrotic tissue which is destroyed beyond redemption.

e. Repair the skin wounds by reapposition and suture.

f. Elevation of depressed fragments is the one most important procedure in this entire consideration. In a median fracture, the broken portions of nasal bone must be raised anteriorly and replaced, not flat, but in their normal arched position. If after this has been done a vertical ridge is still present at each side of the nose, it is due to a fracture outward of the nasal process of the maxilla. With the nasal bones raised into place, the maxillary fragments can usually be pushed medially into proper position.

The elevation is done with any smooth, flat, narrow, thin but strong instrument. Sometimes even the narrow handle of a scalpel will do, but a nasal elevator is, of course, better. The instrument must be of this shape because it must be inserted as high as necessary (being mindful not to injure the cribiform plate of the ethmoid) in the narrow space along the posterior surface of the nasal bones, between these and the septum.

If the lateral cartilages have been torn loose from the lower margins of the nasal bones or the maxillæ, they too must be replaced. If there is a fresh deformity of the septum, this will be much improved by relieving the pressure on it through lifting the depressed bridge anteriorly. If some septal deformity remains and cannot be corrected by gentle manipulation, it will probably have to be corrected later through a submucous resection by a competent rhinologist.

Fresh median fractures, in my hands, usually require no internal splints, especially if the nasal processes of the maxillæ are fractured, since these might be pushed out again. Occasionally an internal splint is advisable, to hold the nasal bones forward and to help keep the septum straight. Many things have been used for this purpose. I favor the compressed cotton tampons of Simpson or Good, because they are easy to insert and swell enough upon absorbing moisture to hold their position. I do not like the ordinary method of simply inserting these splints up behind and parallel to the posterior surface of the nasal bones, for the tampon will slide downward and posteriorly, doing more harm than good. The

Fig. 1. The elevator raises the depressed right nasal bone into position, while the left is pressed medially.

Fig. 2. The manner of measuring and trimming the tampon. This view also indicates the position of the tampon after insertion.

Fig. 3. The shield applied. It does not press on the nasal bones.

tampon must stand perpendicular to the posterior surface of the nasal bridge. Each end of the splint is trimmed with scissors so that after insertion the anterior end may be drawn firmly high and anteriorly into the angle between the septum and the nasal bone, while the lower end is

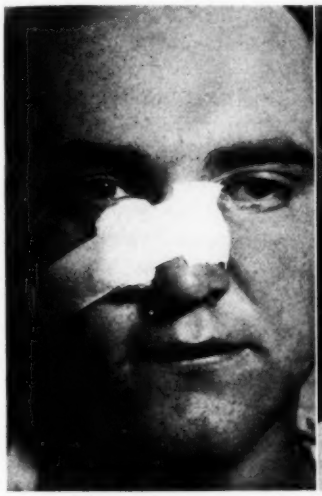

Fig. 4. Traction following replacement of the nasal bones toward the previously depressed side. The fracture was nine days old.

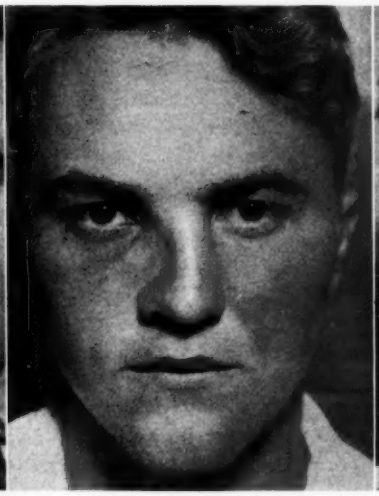

Fig. 5. A typical lateral fracture.

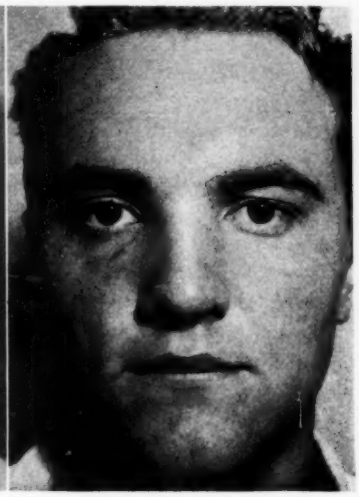

Fig. 6. Patient shown in Figure 5, one week later.

propped against the floor of the nose, anterior to the inferior turbinate or between the inferior turbinate and the septum. Upon swelling, this usually holds its position and is therefore effective immediately behind the nasal bone, where we want it to be. It may be allowed to remain a day or two, after which it is removed or replaced. When covered with petrolatum the splint is easier to remove, and there is less trauma, but it holds its position a little better without the ointment.

As for external splints, a great number and variety have been used for counterpressure on a projecting or recurring deformity. I prefer in such cases to repeat the operation and reset the bones.

I always apply a metal protector over the nose, but without making contact with the nasal bridge. For this purpose we use a piece of sheet aluminum of about 24 or 28 gauge, 1 to 2 inches wide and 3 to 5 inches long, depending on the age of the patient and the size of the nose. The corners are cut off, the sharp edges turned back and the plate bent in the middle so as to form a protection over the nose resting on the cheeks at each side of the nasal bridge and clearing the bridge freely. This plate is then covered with adhesive tape and lined with a thin sterile dressing. The whole is then applied over the operated nose and is held in place with adhesive strips from cheek to cheek and from forehead to cheek. This prevents motion horizontally as well as vertically.

The importance of this metal splint lies in the fact that very frequently a nose may be excellently reformed only to be again distorted within twenty-four hours by rolling on the face during sleep, violently blowing the nose (which at these times is usually congested) and by other careless maneuvers. If deformity recurs, the reduction must be repeated. The skin dressings are changed daily, and the protecting shield is cleaned; usually it must be stripped and covered with new adhesive, the original being blood-stained. Although I am not as a rule a proponent of proprietary medications, I always use 2 per cent aqueous mercurochrome in dressing the skin because it does not injure the eyes and because it seems to have an unusually favorable effect in preventing and treating infections of the skin immediately overlying these fractures. This procedure is repeated daily, and usually in from ten days to two weeks the protector is dis-

carded. Fair union begins to develop in about a week, while firm union may be expected in three to four weeks. The older the deformity after the first four or five days, the harder it is to correct, and the greater the force necessary to separate the fibro-osseous union. The skin dressings are continued as required. Silver nitrate may be used where necessary, being careful that it does not enter the eyes. Some excellent operators use splints made of thin sheet copper which fit snugly over the nasal bridge, resting on the cheeks at each side. It seems to me that, unless the copper is sufficiently firm, there is some chance that the bony arch may be inadvertently depressed, so I prefer a protector which does not touch the nasal bridge. Incidentally, this protector may be cut so as to leave attached to the center of its upper margin a narrow strip of metal which then widens out into a larger plate on the forehead. The latter is firmly fixed in place with adhesive tape.

Occasionally there may be indication for using an Adams forceps. One flat blade enters each nostril and when parallel they are about one-eighth to three-sixteenths inch apart, approximately the thickness of the septum. This is used to raise the nasal bridge and septum into proper position. I rarely find this instrument necessary.

Fresh lateral fractures present a different situation from that found in the median type. The depressed bone stands behind the opposite one, causing the latter to project.

The depressed fragment is raised anteriorly and laterally. This of itself tends to draw the opposite bone medially and often into position. Usually, however, it is necessary to press the projecting bone medially with the thumb or forefinger of the left hand, while elevating the depressed bone with the instrument held in the right hand, or vice versa. When the replacement has been completed, the nasal bridge should be straight and properly arched. It is well to insert a Good tampon as above described in the side which was previously depressed, to help hold this nasal bone laterally. No tampon should be placed in the opposite side. Then the aluminum cover is applied. If the fracture is several days old, there may be a tendency for the fragments to go back into a slight malposition. In order to overcome this, the whole nasal bridge is drawn as firmly as possible with adhesive tape over a small roll of gauze, toward the previously depressed side, into a position of overcorrection. The diameter of the roll of gauze must be a little greater than the height of the nasal bridge, because we do not want to depress the loose bridge while drawing it forcefully to one side.

This overcorrection is not molested for two or three days, when it will be found that there is, in fact, not overcorrection, but rather a straight nose. If the adhesive meanwhile has slipped, it may be reinforced with another strip directly over it. Adhesive plaster sticks to adhesive plaster better than it does to skin. After about ten days, in most cases this plaster may be removed.

In concluding, I wish to repeat my conviction that the well known, simple principles and procedures outlined above can be utilized by many men in the general practice of medicine to correct recent, simple fractures of the nasal bones if the case is not complicated, and if the services of a capable rhinologist are not available.

DISTURBANCE IN FUNCTION OF THE PARATHYROID GLANDS OF CHILDREN*

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IN order fully to appreciate the changes that result from a disturbance in function of any of the glands of internal secretion, a knowledge of the part played by the gland in helping to maintain normal physiologic conditions in the body is desirable. In respect to the parathyroid glands, knowledge of their function is of fairly recent origin.

Gley, in 1891, removed the parathyroid glands of animals and demonstrated that this removal was followed, usually within two or three days, by a set of symptoms characteristic of tetany. Vassale and Generali, in 1900, offered the hypothesis that the symptoms were due to toxins, the effects of which were inhibited in the intact animal by the action of the parathyroid glands. Koch, in 1912, and 1913, found methylguanidine in the urine following parathyroidectomy. From these observations the view developed that the function of the parathyroid glands is the control or detoxification of guanidine in the body. This view generally is considered untenable.

McCallum and Voegtlin, in 1909, demonstrated that, during tetany in parathyroidectomized animals, there is marked reduction in the calcium content of the tissues, especially of the blood and brain, together with an increased output of calcium in the urine and feces, and an increased output of nitrogen and ammonia in the urine. They also found that calcium is of value in the treatment of spontaneous and postoperative tetany in man. Their view, that the function of the parathyroid glands is to control calcium metabolism, has been largely substantiated by subsequent experimental and clinical observations.

Erdheim noted cataractous changes in the lens of the eye in parathyroprivic tetany, and demonstrated that the teeth of rats deprived of their parathyroid glands become opaque, brittle and distorted, and that the bones are, to some extent, decalcified. Experimental parathyroprivic tetany may be improved or controlled by a variety of measures, such as by injection or feeding of calcium salts, production of acidosis by various means, bleeding and injection of saline solution, and by administration of the parathyroid hormone.

The picture resulting from the presence of an excess of the parathyroid hormone is quite the opposite. In animals it results in the following: a rise of calcium to as high as 20 mg. per 100 c.c. of serum; a fall of the serum calcium after thirty-six hours; increased excretion of calcium, phosphorous, and nitrogen in the urine; increased excretion of calcium in the feces; a decreased ratio of nitrogen to phosphorus in the urine; increase of nonprotein nitrogen, urea and plasma inorganic phosphates after twenty-four hours, presumably due to failing renal function; a marked increase in viscosity of blood, decrease in blood volume, increase in blood chlorides, and in the osmotic pressure of the blood; a decrease in electrical excitability, and anorexia, diarrhea, emesis, lassitude, muscular atony, coma, and death. Prolonged injections of smaller doses produce characteristic bony changes in addition to disturbances of metabolism.

Thus, experimental hypoparathyroidism and hyperparathyroidism indicate beyond peradventure that the function of the parathyroid glands is concerned with regulation of calcium metabolism and with maintenance of a constant level of calcium in the blood (tissues).

Clinically, cases are encountered which present features that correspond in all respects to those of experimental hypoparathyroidism and hyperparathyroidism. Among children, hypoparathyroidism is exemplified by the syndrome known as tetany. This may be of the type which occurs, although rarely, after removal of the thyroid gland, when the parathyroid glands may unintentionally be injured, or removed, or it may be of the spontaneous type which occurs among infants and older children. The type of tetany most frequently encountered in the practice of the pediatrician is the infantile type which is associated with low serum calcium rickets. The relationship of this type to parathyroid insufficiency is not clear. It can be effectively and per-

*From the Section on Pediatrics, The Mayo Clinic, Rochester, Minnesota. Read before the Northwest Pediatric Society at the meeting of the Minnesota State Medical Association, Duluth, July 16, 1934.

manently cured by administration of calcium and cod-liver oil. Evidence supports the view that a disturbance of the parathyroid bodies takes place and that this disturbance may be secondary to Vitamin D deficiency. The reciprocal relationship of secretion of the parathyroid bodies and Vitamin D recently has been the subject of considerable study by Wilder, Sheard and Higgins. Its discussion is purposely omitted here. In the postoperative type the causal relationship with parathyroid insufficiency is well established. In the spontaneous type, incrimination of the parathyroid glands is based on the similarity of the condition to postoperative tetany of known etiology. It is to be remembered that, if parathyroid insufficiency is of long standing, not only symptoms of tetany, but trophic changes, notably in the eyes, teeth, hair and bones, may also develop.

On account of the rarity of the condition, I wish to present the case of an older child with spontaneous tetany and to point out the probable rôle of parathyroid insufficiency in its etiology (Fig. 1).

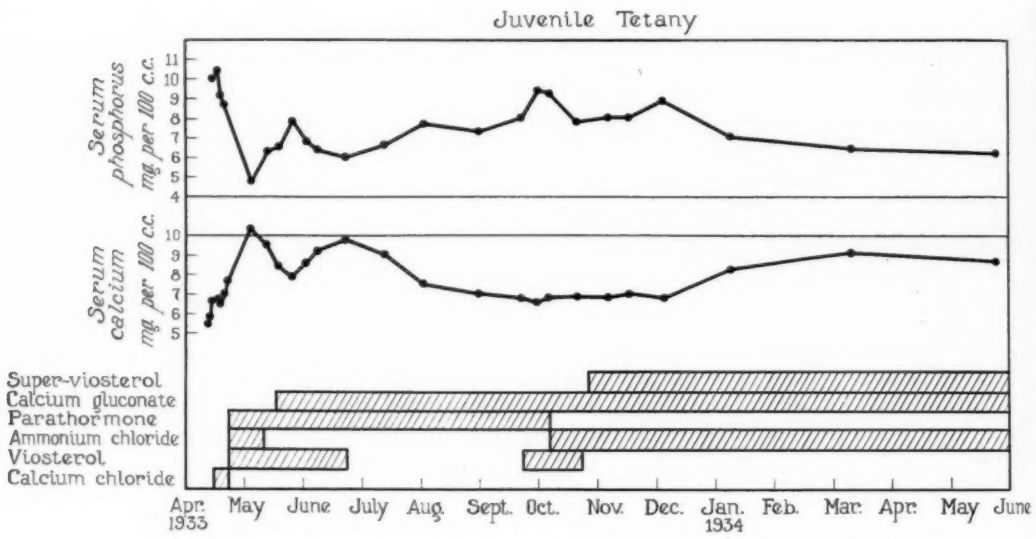

Fig. 1. Influence of various therapeutic agents on values for serum calcium and serum phosphorus in a case of juvenile tetany.

Case 1.—A girl, aged ten years, was admitted to The Mayo Clinic in April, 1933. The complaint was of staring attacks during the preceding two weeks. Her father and mother, and one younger child were living and well. Birth and development had been normal, and the health of the child in the past had been good. She was in the fifth grade of school and was doing good work. She had had acute, suppurative, cervical adenitis in November, 1931, the node had been incised and had healed promptly. Two years before admission, following a gastro-intestinal upset, she had begun to have attacks characterized by flexion of the fingers and, sometimes, of the toes. These had been aggravated by febrile illnesses, intensive study, and by fatigue. The frequency of the attacks had varied from several a day, with residual stiffness which remained all day, to none at all for intervals which had been as long as two months. In the winter preceding admission, the condition had become more marked, so that during the last two weeks she had had about twelve attacks a day, each attack lasting a few seconds. Following the attacks, she had apparently been all right. Loss of consciousness had not occurred. Administration of phenobarbital (luminal) had resulted in vomiting, so it had been discontinued.

On physical examination the child appeared well-developed; she was about 14 per cent overweight. General examination gave entirely negative results, except for the fact that there was considerable grimacing and twitching of the muscles of the face and spontaneous carpal spasms. Chvostek's and Trousseau's signs were extremely marked. The electrical reactions were tested, and the excitability of the nerves was found to be so great that the cathodal opening contraction could not be obtained because of the tetanic reaction following the cathodal closing. The blood calcium levels were 5.5 mg. and 5.8 mg. per 100 c.c. Calcium chloride was administered in doses of 15 grains (1 gm.) three times daily. On the second day after admission, the serum calcium was 6.6 mg. and the serum phosphorus 10 mg.

per 100 c.c. The administration of calcium chloride did not materially alter the symptoms or the serum calcium and serum phosphorus levels. Parathyroid extract, viosterol, and ammonium chloride were then given with very rapid return to normal of the serum calcium and serum phosphorus levels, and the complete disappearance of symptoms. However, after the administration of parathyroid extract for two weeks the serum calcium values became progressively lower and the serum phosphorus values progressively higher; the symptoms returned and, probably because of immunity to parathormone resulting from use of the increased amounts of parathyroid extract, the values were practically the same as those at the time administration of the extract was begun. The patient's symptoms had returned with all their original intensity. Five months after beginning the use of parathyroid extract, it was discontinued, and she was given 15 grains (1 gm.) of ammonium chloride and 6 grains (0.4 gm.) of calcium gluconate; she also was given Mead, Johnson and Company's special viosterol in the dose of 1 drop daily (1 drop contains 10,000 units). Three weeks later this latter was increased to 2 drops, and in two months to 3 drops daily. During this time the serum calcium values increased and serum phosphorus values decreased and, in May, 1934, the serum calcium level was within normal limits, the serum phosphorus level was still somewhat elevated, and the clinical condition of the patient was satisfactory in every way. Trousseau's sign could not be elicited, nor could Chvostek's. The patient is to continue about the same course of medication for an indefinite period.

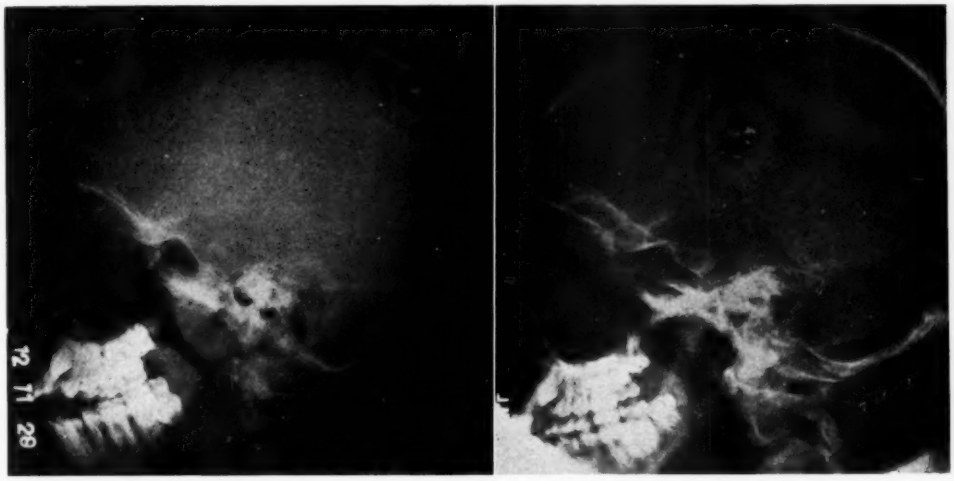

Fig. 2. Hyperparathyroidism. Roentgenograms of skull for comparison. *(Left)* Before operation, at the time of the report by Pemberton and Geddie, showing diffuse granular osteoporosis. *(Right)* Three years after operation, showing normal appearance of skull.

This case is considered one of parathyroid insufficiency because of the following features; positive Chvostek, Trousseau, and Erb signs, spontaneous carpal spasm, and increased general excitability of the central nervous system, together with marked reduction in the serum calcium level and marked increase in the serum phosphorus level. It demonstrates two very important points regarding treatment: (1) the futility of attempting to control the condition by means of parathyroid extract, and (2) the necessity for, and effectiveness of a Vitamin D preparation combined with generous doses of calcium.

Reports of cases of hyperparathyroidism have been appearing in ever increasing numbers. Mandl is credited with being the first to remove a parathyroid tumor in a case of generalized osteitis fibrosa cystica. Pemberton and Geddie, in 1930, gave the first report of a case of hyperparathyroidism in which the patient was a child; since then, other cases of the disease among children have been reported.

The picture in hyperparathyroidism is variable, depending on the severity and duration of the hyperfunction. It is accompanied by a disturbance in calcium and phosphorus metabolism, usually with serum calcium values as high as 20 mg. and with serum phosphorus values as low as 2 mg. per 100 c.c. There is increased excretion of calcium and phosphorus and a negative calcium balance, which may amount to 0.5 or more each day.

The manifestations of hyperparathyroidism

are most evident in the osseous system, but the body as a whole is affected. Painful extremities, weakness, fatigue, nervousness, tachycardia, constipation or diarrhea, and renal colic may be present. The roentgenogram may reveal the decalcification that is typical of the disease, which may appear as diffuse osteoporosis or which may have progressed to formation of multiple bone cysts. Deformities of the bones frequently follow decalcification. Following removal of a parathyroid tumor, the condition improves rapidly and skeletal changes return to normal. Deformities, of course, persist.

I wish to refer, briefly, to the case reported by Pemberton and Geddie. The patient, a girl aged fourteen years, registered at The Mayo Clinic, November 3, 1929. She complained of attacks of vomiting, pallor, and loss of weight. In the year and a half prior to admission she had lost 31 pounds (14.1 kg.). The vomiting attacks had occurred at intervals of about two weeks or less and had lasted from one to five days. She had had polydipsia, and polyuria and nocturia. She was 40 per cent underweight, pale, and emaciated, and appeared to be chronically ill.

Electrical irritability was decreased, and excretion of phenolsulphonphthalein was 40 per cent and 45 per cent in two hours. The values for urea were 80 mg., 37 mg., and 40 mg. per 100 c.c. of blood. The normal value is from 25 to 40 mg. per 100 c.c. of blood. The serum calcium values were 16.32 mg., 17.67 mg., and 15.50 mg. per 100 c.c. before operation. The normal value is from 9 to 11 mg. per 100 c.c. The serum phosphorus values were 2.46 mg., 2.80 mg., and 3.20 mg. per 100 c.c. The normal value is from 3 to 5 mg. per 100 c.c. Immediately after operation the serum calcium values ranged from 7.56 to 7.89 mg. per 100 c.c. and the serum phosphorus values from 2.2 to 4.04 mg. per 100 c.c. The roentgenogram revealed diffuse decalcification of all bones, the water concentration test showed fixation of the specific gravity, and there was a slightly positive phosphorus balance and a slightly negative calcium balance before operation.

A parathyroid adenoma, measuring 1.5 by 1.25 by 1.25 cm., was removed November 16, 1929. Immediately following operation, the patient complained of tingling and numbness in the fingers and toes, and Chvostek's sign was present. Three days after operation, calcium chloride was given intravenously, with relief even before injection was completed. The same day, 10 units of parathyroid extract (Collip) were given subcutaneously. Cod liver oil, viosterol, and calcium chloride were administered daily following operation. The metabolic study after operation revealed a positive calcium balance; electrical excitability of the nerves approached normal. A roentgenogram of the skull made three years after operation gave evidence of a normal condition of the bone (Fig. 2).

This case is of interest because it illustrates the chief clinical, metabolic, and pathologic features of hyperparathyroidism in a child, namely, weakness, abdominal pain and vomiting, anemia, polydipsia, and polyuria, hypercalcemia and hypophosphatemia, decalcification of the bones, and the demonstration of a parathyroid adenoma, the removal of which was followed by immediate improvement and by ultimate recovery. These features satisfy all the requirements for the diagnosis of hyperparathyroidism.

Summary

Recent developments have disclosed facts which have clarified knowledge of the function of the parathyroid glands. Experimentally produced hypofunction and hyperfunction are paralleled closely in cases of hypofunction and hyperfunction of the parathyroid glands of man. Examples of cases of hypoparathyroidism and hyperparathyroidism are presented.

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EDITORIAL

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BUSINESS MANAGER
J. R. BRUCE, Saint Paul

Volume 18 — FEBRUARY, 1835 — Number 2

Simplified Diphtheria Prevention

A study in the allocation of diphtheria mortality by age groups in the State of Minnesota since 1915 reveals the appalling fact that about 45 per cent of all deaths from the disease still occur under five years of age. As a result of immunization, Schick testing, and detection of carriers by culture, the mortality in the group of infected school children ranging from five to ten years of age has declined in Minnesota during the past twenty years from 35 to 8 per cent. It is obvious that more attention must be given to earlier, more adequate, and more far reaching immunization if the mortality for the first five years of life is to be reduced. The opportune time for employing this procedure is the age of six months. In the past there has been some difficulty in accomplishing immunization due to the required multiplicity of inoculations with toxin-antitoxin and formaldehyzed toxin (toxoid).

Recent observations on the use of alum-precipitated toxoid indicate that immunity against diphtheria may be established in a high percentage of individuals inoculated with one dose of 0.5 c.c. of this more concentrated antigen. Personal experience reveals an appreciably higher percentage of negative Schick tests after the use of 0.75 c.c. Its efficacy is attributed to its relative insolubility, which results in a slow absorption and a theoretically prolonged antigenic stimulation. The advantages of a single dose method of immunization are apparent, provided the immunity so established can be shown to be as lasting as that produced by the use of multiple doses of toxoid. The hazard of abscess formation in about one per cent of cases may, however, be a deterrent to the use of this new antigen.

In spite of the slight possibility of an abscess formation following the single injection of the alum precipitated toxoid, this preparation is destined to have a wide field of usefulness in public health projects, more so if this objection can be further minimized.

The older method of giving three injections of toxoid, however, gives a higher percentage of immunization and, not being fraught with the admittedly slight possibility of abscess formation, is therefore better adapted to private practice.

E. S. PLATOU, M.D.

Social Idealism

A world without poverty, disease, unemployment, neglected and crippled children, and old age would be ideal, indeed. Their very existence, however, provides the urge for individual initiative. To imagine that the appropriation of funds by a paternalistic State or Federal Government can solve the problems presented by these evils is fantastic.

The Health Insurance Bill, drawn up by the American Association for Social Security, which is to be submitted to the various state legislatures, and the Wagner Bill already submitted to Congress are outstanding examples of the trend of legislation stimulated by hard times. This Wagner Bill provides for Federal subsidies to States making provision for equal sums for the relief of old age, unemployment, dependent and crippled children, and maternal care. Health insurance is evidently to be handled by the State without Federal subsidy. It is well to re-

flect that the millions of dollars involved are derived from direct or indirect taxation and not from the brimming coffers of a generous government.

The proposed extension of the paternalistic form of government strikes at the very foundations of our economic structure. If the government can care for all these evils incident to existence, what becomes of individual initiative and responsibility? What need for thrift, if old age is provided for? If elderly parents and neglected children will be provided for, there is less need for the family unit.

And how are the necessary funds to be raised? Taxation of pay rolls, high taxes in general and the popular cry of "soak the rich" only serve to cripple industry and prevent expansion.

There is a distinct need of a strengthening of our moral fiber as citizens. There is too much evidence of a desire to get something for nothing and to shirk individual responsibility. The choice of political leaders in some states and lobbies of organized minorities such as that of the American Legion are illustrative. The Townsend plan only indicates to what extremes the followers of a quixotic leader can go.

It behooves intelligent citizens and those who believe the only way out of our economic situation is individual initiative and hard work to oppose the present day tendency to shift responsibility to a beneficent government. An important decision rests with Congress and the members of our State Legislatures.

In Memoriam

Each year a certain number of our members fall by the wayside. Too often the event does not receive a suitable recording in the pages of our journal. More often than not two months elapse before the editorial office receives any notice of the fact.

A record of the life of a physician written by a close friend is much more likely to give due credit to the outstanding qualities of the departed one than any enumeration of events in that life narrated by a total stranger.

When a member of a county medical society passes away a committee is usually appointed from among the intimate professional friends of the deceased to draw up a suitable record of his activities and character. There should be no exceptions. This record should be suitable for publication in the journal where it will serve as a permanent record. Professional friends of non-members or those retired from practice must be counted upon to perform this tribute.

May we not ask the coöperation of the secretaries of the component societies who are among the first to receive news of the loss of a member to arrange promptly for the preparation and submission of a suitable memorial for publication in the pages of MINNESOTA MEDICINE? We also make a plea to the friends of non-members to perform a similar final act of courtesy towards their departed comrades.

OF GENERAL INTEREST

Dr. M. L. Mayland, Faribault, is spending the winter in Florida.

* * *

Dr. Laura A. Lane, formerly of Northfield, is now located at Ann Arbor, Michigan.

* * *

Dr. Lillian L. Nye, Saint Paul, was elected to membership in the American Academy of Pediatrics last fall. Her present address is Cortland, New York.

* * *

Dr. Royal V. Sherman of Knapp, Wisconsin, has become associated with the Bratrud Clinic, Thief River Falls, in the department of internal medicine.

* * *

Dr. Angie G. Stiles, Carleton College, Northfield, was married last summer and is now in Europe taking postgraduate work. She will return in October, 1935.

* * *

Dr. S. B. Haessly, Faribault, recently sustained a fracture of the thigh and is confined in St. Lucas' Hospital.

* * *

Dr. Walter P. Gardner, specialist in nervous and mental diseases in Saint Paul for a number of years, was appointed superintendent of the Minnesota State Asylum at Hastings, Minnesota, and took charge of the hospital, January 1, 1935.

* * *

Dr. W. E. Ground of Superior, Wisconsin, has just completed fifty-two very active years of practice in medicine and surgery. He is still not satisfied, and left on a trip to England, January 18. He expects to do special cancer study in London and elsewhere.

* * *

Dr. Louis B. Wilson, director of The Mayo Foundation, was married January 3, 1935, to Miss Grace McCormick, formerly of Philadelphia, but recently in charge of a playground project in Walnut Hill, a suburb of Rochester, Minnesota. A wedding trip to Florida followed the ceremony in Pittsburgh.

Dr. C. H. Holmstrom of Warren, Minnesota, returned recently from Boston, Massachusetts, where he attended the Harvard post-graduate course in surgery given at the Massachusetts General Hospital. Returning home he visited various hospitals in the larger cities.

* * *

Dr. L. W. Barry of Saint Paul, an associate professor of gynecology and obstetrics at the University of Minnesota, was guest speaker before the Interurban Academy of Medicine meeting at Duluth on the evening of January 16. His subject was, "The Medical and Surgical Aspects of Dysmenorrhea."

* * *

St. Mary's Hospital staff, Duluth, held its annual meeting, with a dinner served in the auditorium of the nurses' home, for ninety doctors and guests. Dr. Gersham Thompson of the Mayo Clinic was the guest speaker. He discussed the present interesting developments in transurethral resection of obstructed prostates. Dr. J. R. Kuth was elected as chief of staff.

* * *

Dr. Elliott C. Cutler, Moseley Professor of Surgery at Harvard University Medical School, will give the second lecture in the annual Judd Lectureship in Surgery on Tuesday, February 19, in the auditorium of the Chemistry Building at the University of Minnesota at 8:15 P. M. The subject of Dr. Cutler's lecture will be "Total Thyroidectomy for Heart Disease." Dr. E. Starr Judd who endowed this lectureship in Surgery is a graduate of the University of Minnesota of 1903.

* * *

The Interurban Academy of Medicine (Duluth and Superior) at its regular meeting, January 16, honored two members, presidents respectively of their state medical societies, Dr. Thomas O'Leary of Wisconsin and Dr. W. A. Coventry of Duluth. Dr. W. E. Ground of Superior, Wisconsin, a past president of the Wisconsin association, pointed out that this is the second time that these lake port cities have synchronously enjoyed this honor. Dr. Ground's administration for Wisconsin coincided with that of the late Dr. W. H. Magie of Duluth, elected in 1907, whose administration covered the year 1908.

* * *

Blue Earth County is trying a new experiment with the county work, in that all the doctors are county physicians. There is a stipulated sum set aside for the year, and each doctor is paid according to the amount of work he turns in. Every three months all the accounts are checked up, and the doctors paid according to the sum set aside. The county takes care of all hospital work, venereal and chronic cases. The SERA takes care of acute cases outside the hospital. The SERA work has been so unsatisfactory that many of the doctors feel it would be much better if all the medical work would come under county supervision. It is to be seen how this plan will work out.

* * *

St. Luke's Hospital, Duluth, held its annual staff meeting, with a dinner served to about eighty doctors and internes, on the evening of January 17. An alert audience was awaiting as guest speaker Dr. H. E. Robertson of the Mayo Clinic. From Olmsted County came the "Byrdlike" report that not even the wind (not to mention trains or buses or cars) was moving, and unhappily, H. E., with most of southern Minnesota, was snowbound! The late Whittier was recalled, and an autopsy held on his memory, all of which shows the provocative propensities and perversity of our times. Dr. J. R. Manley was elected chief of staff.

* * *

Dr. Emil Goetsch of Brooklyn, Professor of Surgery at the Long Island Medical College and Surgeon-in-Chief of the Long Island College Hospital, will address the thirteenth annual Foundation Dinner meeting of the Minneapolis Surgical Society to be held at the Minneapolis Club Thursday, February 7, 1935. The subject of his address will be "Criteria of Operability in Goiter Patients." Following the address Dr. Goetsch will be presented with an honorary membership in the Society.

Dr. Goetsch will also address the Hennepin County Medical Society at 1 P. M., Wednesday, February 9, and the students of the medical school on the campus of the University of Minnesota at 2 P. M., Thursday, February 10.

* * *

At the annual meeting of the Staff of Ancker Hospital, Saint Paul, on January 23, 1935, the Staff was called upon to decide whether its members would accept compensation for their services. There was some reason to believe that a sum of $20,000 or $30,000 might be available to partially compensate the ninety staff members, although just how this sum would be raised or how long it would be continued, no one actually knew. After considerable discussion as to how the remuneration would be handled, whether in direct pay on a basis of years of service and character of service rendered or in the form of annuity insurance, the Staff voted unanimously against changing the precedent of some sixty-eight years' standing whereby the medical profession of Saint Paul has contributed gratuitously its services to the patients in Ancker Hospital.

* * *

Correction—The news item concerning Dr. C. W. Froats, published in the January number of MINNESOTA MEDICINE, stated that he was "of the Duluth Clinic." This should have read "of the Bratrud Clinic, Thief River Falls."

MEDICAL ECONOMICS

Edited by the Committee on Medical Economics
of the
Minnesota State Medical Association

B. J. Branton, M. D. W. F. Braasch, M. D., Chairman J. C. Michael, M. D.

Report of The President

The text of President Roosevelt's long awaited message on social security presented to a public that has been much harangued of late on the subject of inequalities in the distribution of medical care, a very interesting and significant pronouncement on radicalism in general and on Health Insurance in particular.

In the two statements from the text which are quoted below are to be found important aid and reassurance for those in the medical profession who feared radical proposals for the socialization of American medicine. The influence and advice of the experts who represented the American Medical Association on the advisory boards to the President's Committee on Economic Security is also abundantly evident.

Says the President:

"It is overwhelmingly important to avoid any danger of permanently discrediting the sound and necessary policy of Federal legislation for economic security by attempting to apply it on too ambitious a scale before actual experience has provided guidance for the permanently safe direction of such efforts.

"The place of such a fundamental in our future civilization is too precious to be jeopardized now by extravagant action. . . .

". . . I am not at this time recommending the adoption of so-called Health Insurance, although groups representing the medical profession are coöperating with the Federal government in the further study of the subject and definite progress is being made."

So long as the Federal government consults and "coöperates" with groups that truly represent the medical profession, precipitate action which will endanger permanent progress in care of the sick need not be feared.

Special Session

That the situation still holds grave possibilities is indicated in the call, issued just as we go to press, for a special meeting of the House of Delegates of the American Medical Association. Following is the message sent, January 22, to all members of the House:

To the Members of the House of Deligates of the American Medical Association:

In compliance with the official request of the Board of Trustees that the House of Delegates be convened in Special Session, I, as Speaker, under authority of Chapter III, Section 2, of the By Laws, hereby officially call the House of Delegates of the American Medical Association to convene in special Session in the city of Chicago, State of Illinois, at 10:00 a. m., Central Standard Time, on the fifteenth day of February, 1935.

The business to be transacted at this Special Session shall be limited to the consideration of the social and economic policies of the Association as related to the pending and proposed legislation, to sickness insurance and to other matters which may be submitted by the Board of Trustees.

The House shall remain in session, recessing from day to day, until its deliberations are concluded.

Signed and issued in San Francisco, California, January 21, 1935.

FREDERICK C. WARNSHUIS, M.D.
Speaker, House of Delegates
American Medical Association

Anti-Vivisection is Real Menace—Dr. McEachern

Dr. Malcolm T. McEachern, of Chicago, associate director of the American College of Surgeons and Director of Hospitals, visited the Twin Cities recently to arrange for a sectional meeting of the College to be held March 18 and 19, in Saint Paul. He found time between appointments and conferences to talk about a number of things, among them anti-vivisection.

"The real menace to the welfare of medicine right now," said Dr. McEachern, "is the renewed activity of the anti-vivisectionists."

A $6,000,000 gift to the National Anti-vivisection Society has brought opportunists, of all brands, flocking to the Society's standard. Bills will be introduced into every possible state leg-

islature, this session, under the guise of humane legislation, probably with the purpose, first, of procuring exemption of dogs from animal experimentation.

Irene Castle, Leader

The fight is on already in Chicago, where Mrs. Irene Castle McLaughlin, once a dancer, is leading a very energetic campaign to prevent use of unclaimed dogs from the city's pound for experimentation.

The campaign is not confined to the platforms of women's clubs and welfare organizations. It has been carried into the churches and a surprising number of ministers have been prevailed upon to take up the cause of the dogs as against suffering human beings.

It is to be noted, also, that the Chicago newspapers that belong to Mr. William Randolph Hearst have also thrown their headlines and editorials to Mrs. McLaughlin's assistance.

The question will be settled with the election of aldermen this spring. Anti-vivisectionists, with the backing of their large gifts, appear to be sure of influencing a considerable number of Chicago's aldermen.

As to Health Insurance

Says Dr. McEachern:

"The College of Surgeons has only established principles upon which any scheme for pre-payment for medical or hospital service should be guided; nothing more.

"Personally, I believe there will have to be some such plan or series of plans. But it should apply only to the lowest income groups and it should be limited to payment for doctors' and hospital bills.

"It seems extremely unlikely, judging from reports from well informed men, that anything will be done on a large scale now to promote health insurance.

"It is likely, however, that there will be sporadic attempts here and there among the states to experiment with health insurance.

"Conditions in each community differ so much from other communities that a uniform prepayment plan seems hardly possible.

"If times continue to get better there will probably be less and less talk of any radical change—the reason, probably, why Secretary of Labor Frances Perkins and her associates, especially, wish to lay the foundations now for a general program of social security."

Questionnaire

Why Does The Physician Oppose Health Insurance?

When the lay legislator or lawyer or politician asks what is the real objection to Health Insurance, is the medical man thus interrogated going to bluster and become inarticulate? Too often he does just that—not because his feeling on the matter is not honest and based upon truth. But there is a specious sweet reasonableness and a false humanitarianism about the arguments for health insurance that too often halt his reply.

The questions and answers that appear from time to time in this section are designed to assist the average practicing physician in this predicament.

The first series, which appeared in the December issue, covered some of the most frequent questions in their more usual form. The following are sure to be asked sooner or later, also, and perhaps the appended answers will encourage him to explain clearly the medical position and point of view. (We acknowledge our indebtedness to the fine material, including the Catechism on Sickness Insurance, prepared by the Bureau of Medical Economics of the American Medical Association.)

Who Wants It?

Question.—How can you oppose pre-payment plans for medical care when so many people are asking for them?

Answer.—The people who are asking for prepayment health insurance are neither the eligible patients nor the doctors who take care of them. In most of the countries where health insurance is now established, its introduction was opposed by both groups. The first advocates for sickness insurance, have, almost always, been social workers and philanthropists. "These groups," says Dr. Leland in his Catechism, "see in sickness insurance a simplification of their work in providing medical relief. Neither are they blind to the fact that the introduction of a system of sickness insurance will involve employment of large numbers of such social workers."

One Million Dollars a Day

Question.—But if Organized Medicine has shown itself to be indifferent to the welfare of

these low income groups who, naturally, can't be trusted to know what's best for themselves, then why should they object if the social workers assume the responsibility?

Answer.—It is untrue and notably unjust to say that Organized Medicine has been indifferent to the welfare of these low income groups. A very conservative estimate, based upon limited studies, places the value of services donated by the physicians of the United States to the care of indigents and low income classes during the last few years at about one million dollars a day. Certainly, if there is any section of the people that has not been indifferent to the problem of medical care for indigents it has been the organized medical profession of the United States. Practically every institution offering service to these classes depends for its existence upon donated services of physicians.

In addition, state and county medical societies throughout the country are trying to find a sound method for giving good medical care at a price within their ability to pay to people with low incomes. A number of the experiments that offer the best promise have been originated in and are now being carried on by such societies.

In all of these experiments, however, the prime object has been to maintain the conditions on which the doctor knows good medical care depends.

The threat to good medical care has been the basis of criticism offered by physicians to wholesale plans offered by social workers, philanthropists, employers, laymen, very few of whom have shown their devotion to these same low income classes that has been shown by the medical profession.

Insurance and Preventive Medicine

Question.—But what if the practice of medicine should be hampered somewhat by organizing and regimenting it a little according to the plans of the social workers; wouldn't that misfortune be more than offset by the fact that unlimited service would be available to encourage preventive medicine and the detection and treatment of incipient disease?

Answer.—That question can best be answered by looking at the experience of European countries, notably England and Germany. In these countries even the most enthusiastic advocates admit that sickness insurance has done little to develop or encourage measures for prevention of disease.

The insurance practitioner is too hurried and too closely restricted to spend time on immunizations and general health examinations. Such work is done better in America without sickness insurance than anywhere else in the world.

By the same token, physicians who are familiar with insurance work point out that, both in England and Germany, the physician's office is more than likely to be full of patients who are manufacturing symptoms in order to "get something out of" their insurance payments and the tendency of the over-crowded practitioner is to make light of all reported symptoms.

No advocates of insurance have ever assembled any figures to show that cancer or tuberculosis are discovered earlier and are more successfully treated on that account, in the countries having health insurance than in others.

Medical Principles

Question.—Isn't the real objection of Organized Medicine to sickness insurance bound up in the fact that physicians fear their incomes will be lowered and standardized?

Answer.—The real objective of organized medicine has always been, first, to fight disease and to guard the health of the people. In this respect it is set apart from every other association. While most other associations make the improvement of the economic conditions of their members the first object, the medical profession has always put the welfare of the indivdual and the public first. It is from this point of view and with a record of more than a thousand years' adherence to these principles that Organized Medicine approaches the problem of health insurance.

Nowhere has it declared itself as against the principle of insurance as a method of payment for medical service. It has emphatically opposed specific schemes for sickness insurance because they endangered the quality of medical service and therefore threatened the public health.

Some Causes of Professional Unrest

An article by R. G. Leland, M.D., of the Bureau of Medical Economics of the American Medical Association, which appeared recently in

the *Journal of the Iowa State Medical Society*, is worthy of detailed consideration.

"Medical Economics," says Dr. Leland, "is, in the minds of some, a matter solely devoted to the increase in the business of a physician, the size of his practice, and the increase in the percentage of his collections. It has a much larger scope, and the purely business side of medicine is merely an incidental or subsidiary feature."

Contract Practice

Among the causes of unrest that have appeared during our economic depression, Dr. Leland enumerates the following beginning with contract practice.

Although it must be admitted that some forms of contract practice are legitimate, necessary and ethical, nevertheless he makes the following criticisms in regard to this form of practice:

"Contract practice, with its solicitation, its advertising, underbidding and racketeering, and its commercial, competitive features, in my opinion has spoiled more good physicians than any other one form of medical practice. It is because of the undesirable, dangerous, destructive features of contract practice that we find it among the leading causes of professional unrest today.

"Contract practice introduced the commercial competitive basis of the practice of medicine. Under those conditions, physicians are not allowed to place, uppermost and foremost, their ability to diagnose and to treat disease. They compete on a commercial basis, on a basis of doing a certain amount of work for a certain sum, and if they are not successful, one of their competitors is awarded the contract the next year, because he will do it cheaper per piece than they. The following year, they strike back at the competitor by offering to do the same work for less money or to do more for the same money."

Medicine Deteriorates

Regarding attempts to mechanize, to socialize, or to sovietize medicine, Dr. Leland makes the following statement:

"They are, perhaps, the strongest of the disturbing elements to physicians today. It is hard to tell just exactly what might happen were such an event to occur in these United States, but I can state, truthfully, that I see some comfort in the fact that I believe the American people desire their own physicians. They do not want the kind of medicine that is dealt out mechanically. They do not realize as well as we do what the mechanization and sovietization of medicine means to them, but it is for us, the physicians of these United States, who, by tradition, training, experience, and ability, know what happens to the quality of medical care when socialization of medicine takes place, to point out how the quality of care deteriorates, under such a system. This deterioration has taken place in all the sickness insurance systems in Europe, perhaps to the least extent under the system that is in vogue in Great Britain."

Group Hospitalization

Of the scheme for group hospitalization contracts, he says that sooner or later they will lead to health insurance, with its attendant ills. He says:

"Hospitals should raise the amount necessary to meet their financial obligations by some other way than by urging the poor and the low income group people to carry a portion of the hospital debt retirement program."

He makes the following suggestions in regard to the solution of our present problems:

"It seems to me that the effects of all of these disturbing elements ought to be fairly clear. One of the first effects should be the creation of a strong, united effort on the part of the medical profession to resist all of these socialization efforts and to maintain, as rigidly as possible, the quality of medical service. We do not deny that there may be some weaknesses in the method used for the practice of medicine today, but is it necessary that the entire structure of medicine be destroyed, that the method of practicing medicine in the United States be overturned, in order that we correct certain minor deficiencies which exist here and there?"

The Doctors' Tradition

"One of the major tasks, however, of the medical profession is to unite physicians in a strong resistance against a common foe, not solely for the sake of professional gain, but primarily to preserve that type of medical care which is best for the public. If we keep uppermost in our minds the fact that we as physicians have a tradition, that we as physicians have an obligation to society, that we have always enjoyed a freedom for research, that we are the only ones who are capable, by reason of training, experience, and licensure, to pass upon medical problems, then it seems to me it ought to be clear that the medical men throughout these United States should unite to keep medicine as a profession and to deliver the best medical care possible to the people of the United States."

County Officers' Meeting

The County Officers' Conference for 1935 is scheduled for Saturday, February 23, at the Hotel Lowry, in Saint Paul.

From the point of view of medical organization and the handling of social and economic problems that affect medicine in Minnesota, this conference is the most important of the year.

Officially, it is a meeting of officers of county and district medical societies of the state for joint administrative problems. But all members are invited to attend and the program as now tentatively arranged will be devoted chiefly to great practical problems that face medical men in Minnesota today.

One is the problem of malpractice insurance, the increasing malpractice litigation, its causes and results in the lessened good repute of the profession and in steadily advancing rates for malpractice insurance.

Another is the medical relief problem, which will be thoroughly discussed by officials from the SERA and by councilors and committee chairmen of the state society who have kept a guiding hand on relief policies of the association.

State legislation as it affects the practice of medicine in Minnesota and a consideration of current schemes for Health Insurance are also scheduled.

Dr. M. C. Piper, Rochester, will preside at the morning session which opens with a breakfast for secretaries at 8 A. M.

Dr. E. A. Meyerding, Saint Paul, executive secretary, will preside at the luncheon session.

Northwest Conference

The Northwest Medical Conference originated under the auspices of the Minnesota State Medical Association years ago.

It was designed by its founders to serve as an opportunity for the yearly exchange of ideas and discussion on common problems of officers of state medical societies in this region.

It has grown to be one of the most distinguished and notable conferences on the social and economic problems of medicine in the United States. Its representatives include officers and councilors from Michigan and Indiana to Colorado and Wyoming.

The program allows time for informal discussion as formerly but it includes, also, a series of important formal papers which are awaited each year with interest by those who are shaping the public policies of medicine in the United States.

The conference continues to be held in Saint Paul each year, on the day following the County Officers' Conference, and each year more of the county officers who come to Saint Paul for their Saturday meeting remain for the Sunday gathering also.

Following is the tentative 1935 program. Dr. Philip Kreuscher, Chicago, president of the Conference this year, will be the presiding officer. The program was arranged under the supervision of Dr. Robert L. Parker, Des Moines, secretary of the Conference.

Program

8:30 Breakfast
Informal Discussion

9:30 Opening Remarks—Philip H. Kreuscher, M.D., Chicago, Ill.

9:45 The Problem of Medical Care:
For the Indigent—E. M. Farr, M.D., Billings, Mont.
Discussion—Rolla Packard, M.D., Chicago, Ill.; E. C. Baumgarten, M.D., Detroit, Mich.
For the Unemployed—Charles H. Philfer, M.D., Chicago, Ill.
Discussion—E. E. Wheedon, M.D., Sheridan, Wyo.; E. J. Goodwin, M.D., St. Louis, Mo.

10:45 Sickness Insurance—Mr. A. M. Simons, Bureau of Medical Economics, American Medical Association
Discussion—Gordon F. Harkness, M.D., Davenport, Ia.

11:15 Medical Journal Advertising—Mr. Harvey Sethman, Denver, Colo.
Discussion—A. S. Hamilton, M.D., Minneapolis, Minn.; B. R. Corbus, M.D., Grand Rapids, Mich.

11:45 The New Set-up of the State Board of Health of Indiana—Thurman B. Rice, M.D., Indianapolis, Ind.
Discussion—A. J. Chesley, M.D., St. Paul, Minn.

12:15 Dinner

1:30 Medical Legislation
National—Mr. Thomas A. McDavitt, American Medical Association
Discussion—C. B. Wright, M.D., Minneapolis, Minn.
Local—R. L. Sensenich, M.D., South Bend, Ind.
Discussion—John R. Neal, M.D., Springfield, Ill.; A. W. Anderson, M.D., Lexington, Nebr.

2:30 Survey of Basic Science Laws—W. G. McGee, M.D., Watertown, S. D.
Discussion—Fred Moore, M.D., Des Moines, Ia.; L. W. Larson, M.D., Bismarck, N. D.

3:00 Postgraduate Medical Education—D. J. Glomset, M.D., Des Moines, Ia.
Discussion—Mr. Tom Hendricks, Indianapolis, Ind.

3:30 Scientific Exhibits—W. A. O'Brien, M.D., Minneapolis, Minn.
Discussion—Mr. George Crownhart, Madison, Wis.; Thomas A. Burcham, M.D., Des Moines, Ia.

4.00 Commercial Exhibits—Harold Camp, M.D., Monmouth, Ill.
Discussion—J. D. McCarthy, M.D., Omaha, Nebr.; J. F. Hassig, M.D., Kansas City, Kans.

Medical Practice in Utah

A pamphlet entitled, "A Survey of the Medical Services and Facilities of the State of Utah —1934, December," arrived the other day. The survey was made by members of the Committee on Medical Economics, Public Policies and Relations of the Utah State Medical Association and the Secretary. Such surveys are being made by various states and should be a guide in any action which may be taken by organized medicine.

There is an apparent uniformity of results in reports of this kind. The economic status of the profession in Utah is probably representative of most of the sparsely settled states in the west and is not dissimilar from conditions in any of the states other than those which are largely industrial.

Incomes Reduced

It is of interest to note that the gross income of physicians in 1933 averaged $3,486, in comparison with $9,986 in 1928. The reduction of average gross incomes from 1928 to 1933 equalled 40 per cent.

The average net income for 1928 was $6,131; for 1933, $3,038, or about $250 per month. The reduction of average net incomes amounted to 50 per cent.

The average expenses dropped 21 per cent as compared with the gross income drop of 40 per cent, or a net income drop of 50 per cent. The average professional income expense in 1933 was 46 per cent.

In 1933, 23.6 per cent of the physicians of the state had a net income under $2,000 per year and 61 per cent had incomes under $3,000.

Little Idle Time

The report of the Committee on the Cost of Medical Care stated that much of a physician's time is idle. This survey shows that the average number of hours of work per week was 63.7. In several cases, it was 70 hours or over and one physician averaged 104 hours per week throughout the year. A survey as to the net income per hour of work showed the average to be 97 cents per hour, which does not compare favorably with bricklayers and masons, and so forth.

It is of interest that the total gross income of 510 physicians in Utah was $2,187,000, or $5.50 per capita of the population. In 1928 it was $4,918,000, or $9.70 per capita of the population. This does not seem to be an excessive amount for care of health.

A report from Salt Lake County estimated donations of medical services by physicians for which they received no pay as $500,000 per year, or three times the amount of the Community Chest for Salt Lake City.

It is to be noted that in all charity agencies which have to do with the health of patients, practically everyone else except the physician is paid for his services. Supplying such free service by the physician is not a simple donation of time; it involves the actual expenditure of money by him for expense. It is estimated that in the first three months of 1934, 29 per cent of all medical work in the state was charity to those unable to pay. However, in several counties this reached as high as 75 or 80 per cent of all the work done.

Recommendations

The recommendations for any proposed plan for medical care included the following principles:

1. Freedom of choice of physicians.
   Plan to be opened to all qualified members of local profession.
   Plan to be identified with present organizations.
2. Control of Medical Service by State and County Societies.
   No restrictions on treatment or prescribing except those formulated by these bodies.
3. Confidential relation between patient and physician.
4. Divorce from unemployment insurance.
5. No third party between patient and physician in medical relation.
   No third party between patient and physician in financial relation except the medical societies.
6. Limited to low income groups.
7. Care of indigent and marginal groups to be provided by state and profession jointly.
   Determination of economic classes by joint agreement.
8. Adequate compensation of physicians.
9. Provision for preventive medicine and health education.
10. Maintenance and improvement of professional standards.
    Education of physicians.
    Check on the unscrupulous.

11. Provision for coöperative research.
12. Fee basis (modified) for payment to physician.
13. Immediate partial cost to be borne by patient.
14. No commercial solicitation.
15. Master contract by state association; subcontract by county society.
16. Initial plans to cover only employed groups with payroll deduction.

Detroit Is Grateful

From *The Detroit Medical News*, bulletin of the Wayne County Medical Society, for January 14:

"The Medical Service Bureau of the Wayne County Medical Society has demonstrated that the medical profession can meet today's challenge of good medical care for all—not through insurance, not through government or political agencies, but through its own organization, the County Medical Society.

"The Bureau has brought complete medical care (including services of physicians, hospitals, dentists, nurses and pharmacists) to 1,541 (as of Jan. 7, 1935) employed wage earners of small means and has arranged plans for all of the applicants whereby the accounts are being liquidated in small installments.

"Because the Bureau is being controlled by the professions, free choice of doctor and preservation of the fundamentals of good medical service are assured.

"The average wage earner does not want charity. Having a job, he is ineligible to receive help from charitable organizations. And yet, because of unemployment periods, short hours and reduced pay schedules, he may have had his financial reserves depleted and be unable to meet a medical crisis, if it should arise, and involve a considerable sum of money. While he may be able to pay for a two-dollar office call, it is impossible for him to meet, in one payment, a protracted illness costing, say, twenty-five to two hundred dollars.

"The purpose of the Medical Service Bureau is to modify the financial barrier of cost, and give this group of people the medical care they are properly entitled to receive.

"It is an honest attempt to help the in-between fellow. It now permits the employed wage earner in Detroit, and Wayne county, to get complete medical care for himself and his family without having to resort to the charity clinic or dispensary.

"How do the wage earners react to the services of the Bureau? The experience so far is that the patient is greatly relieved to learn that complete service will be rendered and NOT THROUGH CHARITY. Patients have shown their gratitude in a very substantial manner by contributing in small installments of one, two, or three dollars (occasionally a little bit more) the surprising total of $35,643.67 (as of Jan. 7, 1935)."

The Medical Service Bureau of the Wayne County Medical Society is an agency of the society, as the above quotation indicates. It assists employed patients of low income to secure needed medical care from the doctors and hospitals of their own choice on terms that they are able to meet. Many of the large employers of Detroit are assisting the agency by actual financial assistance to their employees or by bringing the service to the attention of their employees. Medical economists all over the country are watching with great interest this and other similar experiments undertaken by various state and county units of organized medicine.

State Meeting

The progress, to date, of preparations for the Eighty-second Annual Meeting of the Minnesota State Medical Association, to be held in the Minneapolis Auditorium, June 24, 25, and 26, is worthy of note.

Completion of program plans waits upon the February 2 meeting of the Committee on Scientific Assembly.

The tentative schedule worked out at previous meetings calls for some radical program departures and novelties.

Part of these are concerned with the joint sessions with the American Association for the Advancement of Science, which holds its summer meeting at the University of Minnesota during the same week.

The first of these joint sessions will be held at the Auditorium, Tuesday morning. It will take the form of a symposium on anemia and a series of world-famous medical men will be brought by both organizations for the occasion. The other will be an evening meeting at the University, Tuesday evening.

The "Three A. S." has purposely left its afternoons open so that its members may visit the exhibits and demonstrations at the Auditorium.

Scientific demonstrations and exhibits have become a distinctive feature of the Minnesota

meeting and will have especial emphasis this year. Ramps and corridors bordering the exhibit halls all will be utilized for demonstrations and individual moving pictures and exhibitions.

An unprecedented number of famous guest speakers will be available for this meeting, also, owing to the fact that several other scientific societies have followed the lead of the Minnesota Radiological Society which, last year, established a lectureship for the state meeting. Five other societies, the Northwest Pediatrics Society, the Minneapolis Surgical Society, the Minneapolis Clinic Club, the Minnesota Academy of Medicine and the Northwest Ophthalmological Society, will provide out-of-state speakers besides those provided by the Hennepin County Medical Society, the Minneapolis Citizens' Aid Society, the Minnesota State Medical Association, and the Radiological Society. These will be in addition to those secured by the "Three A. S."

The Annual Meeting is one of the great yearly projects of the association, an essential feature of the post-graduate work of the association and an indispensable means of tightening the bond which holds physicians of the state together and unites them in defense of medical standards and the welfare of the public.

It has gained a national reputation for its distinctive quality and exceptional attendance in the last few years—a reputation which may be measured by its popularity with commercial houses as a means of reaching the medical profession of this part of the country.

As much exhibit space as the total sold in Duluth last summer has already been engaged or paid for in advance by approved firms who cater to physicians. The total number of spaces sold is thirty and the names of exhibitors, listed below, should be remembered as good friends of the profession by physicians:

Abbott Laboratories
North Chicago, Ill.

C. F. Anderson Co., Inc.
Minneapolis, Minn.

Bard-Parker Co., Inc.
Danbury, Conn.

Bilhuber Knoll Corp.
Jersey City, N. J.

Brown & Day, Inc.
St. Paul, Minn.

Cambridge Instrument Co.
New York, N. Y.

Chippewa Springs Corp.
Minneapolis, Minn.

Jos. E. Dahl Co.
Minneapolis, Minn.

DeVilbiss Co.
Toledo, Ohio

Gerber Products Division
Fremont, Mich.

Health Products Corp.
Newark, N. J.

Kellogg Company,
Battle Creek, Mich.

Lea & Febiger, Publishers
Philadelphia, Pa.

Lederle Laboratories
New York, N. Y.

Mead Johnson Co.
Evansville, Ind.

Mellin's Food Co.
Boston, Mass.

Medical Protective of Fort Wayne
Wheaton, Ill.

Wm. S. Merrell Co.
Cincinnati, Ohio

Merck & Co.
Rahway, N. J.

Minneapolis Artificial Limb Co.
Minneapolis, Minn.

V. Mueller and Co.
Chicago, Ill.

Petrolagar Laboratories
Chicago, Ill.

Physicians & Hospitals Supply Co.
Minneapolis, Minn.

Sharp & Smith
Chicago, Ill.

E. R. Squibb & Sons
New York, N. Y.

U. S. Hospital Supply Co.
Minneapolis, Minn.

Winthrop Chemical Co.
New York, N. Y.

We Apologize

The writers of these columns regret if any comment made in the January issue regarding the newspaper article which appeared concerning removal of school children's tonsils in Ashland, Wisconsin, caused any unfavorable reaction. The surgeons in charge, in Ashland, have pointed out to us that the operations were performed only after careful examinations over a long period of time and without any haste or anything suggestive of wholesale surgery. They have also pointed out that the work was done at the request of the Emergency Relief Administration and the fees charged were nominal under these circumstances.

We wish, therefore, to retract any invidious comment, which was made from the information in the newspaper article alone and without careful investigation.

In Memoriam

Joseph Albert Hedding

1883-1934

Dr. Joseph Albert Hedding, a well known practitioner in Minneapolis, with offices in the Medical Arts Building, died December 26, 1934, of hypertension and arteriosclerosis.

Dr. Hedding was born in Minneapolis on March 5, 1883, graduated from South High School and from the Hamline Medical School in the class of 1906. After serving one year as interne at St. Joseph's Hospital, St. Paul, he located in Hope, North Dakota, where he practiced until 1912, when he removed to Minneapolis and practiced there continuously until his death. He was married in 1907 to Ada Benjamin of Minneapolis who, with three sons, survives him. He was a member of the Hennepin County Medical Society, the Minnesota State and the American Medical Associations and the Phi Rho Sigma medical fraternity.

Dr. Hedding had the faculty of making friends. His genial and sympathetic nature, combined with his skill, won for him a large practice. He enjoyed sports of all kinds and won honors in bowling on several occasions at the Minneapolis Athletic Club, of which he was a member.

Dr. Hedding was buried from St. Thomas Church and at St. Mary's Cemetery. The honorary pallbearers were members of the Hennepin County Medical Society.

ROBERT WILLIAMS, M.D.

Arthur F. Kilbourne

1856-1934

Dr. Arthur F. Kilbourne died at his home on November 30, 1934. He was born at Keokuk, Iowa, January 5, 1856, where he received his early education. He graduated from the University of the City of New York in 1883. He spent some time at the hospital on Wards Island in the City of New York, and from there went to the State Hospital at St. Peter, Minnesota, where he served as assistant physician for four years.

He was appointed superintendent of the Rochester State Hospital on June 6, 1889, twelve years after that institution had been established, and served as superintendent of this institution until the time of his death. Under Dr. Kilbourne's management the Rochester State Hospital became one of the best in the country. He established a training school for nurses in 1890. As a result of his administration the hospital grounds are most attractive; the wards and corridors are bright and cheerful, always attractive with a generous supply of flowers and growing plants. In fact, Dr. Kilbourne's cheerful and generous character is reflected in these things, in his endeavor to make as cheerful and pleasant as possible the surroundings of the State's unfortunate wards.

Dr. Kilbourne was a member of the local, state and national medical societies. He was a past president of the Olmsted County Medical Society and of the American Psychiatric Society.

Had he lived two weeks longer he would have completed a period of fifty years' service to Minnesota State Hospitals.

On October 9, 1888, Dr. Kilbourne was married to Miss Ella Donahower at St. Peter, Minnesota. He is survived by his wife; a son, A. D. Kilbourne; and a daughter, Katherine Kilbourne, both of Chicago.

Dr. Kilbourne was always interested in local and civic affairs and for twenty-five years had been senior warden in the Calvary Episcopal Church of Rochester, Minnesota.

Dr. Kilbourne will be remembered as a man of the highest type in his profession. He was dignified but always friendly and cheerful, with a fine sense of humor. He was eminent as a physician and a good administrator, but his friends will remember him chiefly because he was always a gentleman.

Jacob Welcome Bray Wellcome

1869-1935

Dr. J. W. B. Wellcome, for thirty-nine years a practicing physician and surgeon of Sleepy Eye, Minnesota, died at the age of sixty-five at his home, January 10, 1935, following an illness of five years.

Dr. Wellcome was born in Garden City in 1869. He was a cousin of Sir Henry Wellcome, founder of Burroughs-Wellcome Company. Dr. Wellcome graduated from the St. Louis College of Physicians and Surgeons in 1890. Following a postgraduate course at Rush Medical College, he returned to Sleepy Eye to practice with his father, Dr. J. W. B. Wellcome, Sr.

Dr. Wellcome was active in city affairs, serving in the City Council from 1913 to 1915, when he was appointed to serve the unexpired term of Albert Hauser as mayor. He continued as mayor until April, 1919, and during this period many lasting civic improvements were made in the way of extension of water and drainage facilities and the removal of telephone lines from the main street. Dr. Wellcome also served on the School Board for six years.

For years Dr. Wellcome was the local surgeon for the Northwestern Railway and was also a member of the United States Pension Examining Board. He was a member of the Redwood-Brown County Medical Society, Minnesota State and American Medical Associations.

Dr. Wellcome was married October 1, 1891, to Miss Margaret Emmerich of Sleepy Eye. He is survived by his widow and one daughter, Mrs. Lynn E. Jensen of Austin.

TRANSACTIONS *of the* MINNEAPOLIS SURGICAL SOCIETY

STATED MEETING HELD NOVEMBER 1, 1934

The President, DR. MARTIN NORDLAND, in the Chair

GALL BLADDER DISEASE*
A Critical Clinical Study

Thorvald Peterson, M.D.

Before elucidating the subject, let us pay tribute to the vision and courage of the old pioneers who have led us to the present stage of surgery, now called the queen of arts. Zambeccari, the Italian physiologist, in 1630, removed the gallbladder from a dog and ligated the stump; the animal recovered. Michael Entmuller in 1667 concluded from experiments made by Teckop on dogs that removal of the gallbladder had no effects on the bile passages. His statement, "There are no medicines which will dissolve gallstones," undoubtedly paved the way for radical surgery of the gallbladder. The first deliberately planned operation for gallstones was carried out by Gene Louis Petit in 1743. He punctured the gallbladder and extracted the stones with the aid of forceps. In the year 1882 Bernhard Langenbeck performed the first cholecystectomy on a human being and the patient made a speedy recovery. Reidel in 1888 devised choledocho-enterostomy for cure of idiopathic dilatation of the common duct; the patient died of peritonitis. Sprengel in 1891 is credited with the first cure for this condition.

So many contributions have been made to surgery of the gallbladder that only a few of the more outstanding pioneers can be mentioned in this thesis. No paper would be complete without the names of Courvoisier and Thiriar of France, and Ohage of our own country.

In attempting to evaluate our results in gallbladder surgery, I believe it is as difficult as finding out a man's real character, but I have been told on good authority that the quickest manner to secure reliable information is to go to his neighbors, and this gave me the idea of searching the literature for our medical confreres' opinions of the results following gallbladder operations. Our medical colleagues state that 41.5 per cent of individuals who have had operations upon the biliary tract come back after from one to thirteen operations, still complaining of symptoms of gallbladder disease or so-called biliousness.

I was rather astonished to learn that so large a percentage should return with symptoms of cholecystic disease after some form of gallbladder surgery, and, therefore, decided to investigate a series of our own cases. I selected a five-year period, 1921 to 1926. During these five years 651 patients were operated upon at Fairview Hospital for cholecystic disease, including all varieties of inflammation from mild catarrhal to gangrene. In this series there were fifty-nine deaths, or a hospital mortality of 8.9 per cent. I sent questionnaires to the surviving 592 patients, asking the following questions:

1. Are you entirely well from the symptoms for which you sought relief?
2. If you are not entirely well, has your general health improved?
3. Give any other information relative to your case that you think important.

Three hundred and twenty-seven patients answered the questionnaire; not a very large number on which to base conclusions, but let us take them for what they are worth.

Of the 327 patients who answered the questionnaire, 197 (about 60 per cent) had cholecystectomies, and 130 (about 40 per cent) cholecystostomies. In the 197 cases of cholecystectomies, there were 130 cases of cholecystitis without stones (about 60 per cent), and sixty-seven cases of cholecystitis with stones (about 40 per cent). Of the 130 patients diagnosed cholecystitis without stones, sixty-eight (53 per cent) stated they were cured. Sixty (47 per cent) were not entirely relieved of their symptoms. One hundred and six (81.5 per cent) of the 130 patients stated they were improved by the operation. None of the 130 cases has had operations elsewhere since leaving the hospital. Of the sixty-seven patients undergoing cholecystectomies for cholecystitis with stones, fifty-six (83 per cent) stated they were cured. Eleven patients (17 per cent) stated they were not entirely relieved. Sixty-three (94.2 per cent) stated their general health had improved. Only four (5.8 per cent) stated they had received no benefit from the operation. One patient in this series has died since leaving the hospital. Two have had operations elsewhere for symptoms similar to those for which they sought relief.

In our series of 197 cases of cholecystectomies, the incidence of cure was 31 per cent greater when the cholecystic disease was associated with stones. In our series of 327 patients who answered the questionnaires, 130 cases were cholecystostomies. Fifty-two per cent of these stated they were entirely relieved of the symptoms for which they sought relief; the other 48 per cent had such a multiplicity of complaints that no attempt will be made to discuss them here, and they must be recorded as failures as far as cure is concerned.

To summarize these statistics, it will be seen that in cholecystectomies for cholecystitis with stones the results are very favorable—83 per cent cured—while in cholecystectomy for cholecystitis without stones only 52 per cent were cured. The average percentage of

*Inaugural Thesis.

cure in our series of cholecystectomies was 67.64 per cent. This leaves 32.36 per cent who will no doubt seek relief for biliary symptoms elsewhere. If we now include our series of cholecystostomies, with only 62 per cent stating they were cured and 48 per cent not relieved of their symptoms, the grand total that will visit the practitioner for relief of biliousness will be about 40 per cent. This checks quite closely with Dr. Smithie's statements that 41.5 per cent of individuals having had operations upon the biliary tract come back to the practitioner after multiple operations on the biliary tract, still complaining of their original syndrome.

To understand and treat this common condition effectively is, therefore, a matter of great practical importance. When we consider the multiplicity of duties performed by the liver and the fact that these functions may be relatively or equally involved in the presence of hepatic disease, is it any wonder that so large a percentage come into our practice after from one to thirteen operations, still complaining of biliousness? Were it not for the enormous functional reserve and regenerative power of the liver, our failures would be still greater. It is a well known fact that hepatic tissue may be permanently reduced to as low as 15 per cent of the normal amount without pronounced impairment of liver functional efficiency if a proper dietary régime is maintained. This explains the frequent failure to demonstrate functional impairment even in the presence of advanced anatomical changes primary in the liver or secondary to lesions in the extra-hepatic biliary passages, and is the reason for the inefficiency of tests such as the Van den Berg and others. It is essential to know and consider not only the more important functions of the liver and the bile passages, but also the etiology and pathology of the entire gland and its ducts, in order to determine the best treatment and surgical procedure that will give us the greatest percentage of cures.

In this paper the functions will not be discussed, but the paper would be incomplete without mentioning the important ones.

The part played in carbohydrate metabolism by the liver is chiefly: (1) the maintenance of normal glucose concentration of the blood; (2) the removal of glucose from the circulation in its passage from the intestine. In the protein metabolism its chief function is deamination of amino-acids, urea formation, and the formation of fibrinogen. In fat and lipoid metabolism it is necessary to have an adequate supply of bile salts in the small intestine to obtain satisfactory saponification and absorption. But little is known of cholesterol metabolism. However, it has been demonstrated that the liver contains an enzyme (esterase) which is capable of splitting cholesterol esters (the reversible reaction of synthesis of cholesterol ester from fatty acids and free cholesterol and of hydrolysis, by means of esterase) into free cholesterol and fatty acids, a process probably occurring constantly in the liver. In addition, it is well known that the liver is the channel of elimination of cholesterol, which is excreted in the free state in the bile.

Another very important function of the liver is that of a detoxifying agent. In this it is believed to play an important part in protecting the organism from various toxic substances entering through the intestinal tract. This detoxifying function is believed to involve processes of oxidation and conjugation into relatively non-toxic substances which are subsequently eliminated in the bile and urine. For example, indol absorbed from the intestine reaches the liver through the portal system, is oxidized into indoxyl, conjugated with sulphuric acid and eliminated in the urine as indoxyl sulphuric acid.

The liver also differs from other glands in that it receives a supply of blood from arterial and venous sources, and that the greater supply is venous, coming from the organs drained by the portal system. This intricate circulatory mechanism suggests that a significant function of the liver is an exchange of substances carried to the organ by the blood and that the liver anatomically and physiologically is composed of two organs, namely, the parenchymal cells of the liver and the reticulo-endothelial cells similar to those found in the spleen and bone marrow.

The pathological changes are more interesting from the standpoint of the surgeon, and the most outstanding features of disease in the biliary system is the tendency to the formation of gallstones. The complete chain of events underlying the primary formation of these calculi is not yet completely understood. We do, however, understand the paramount significance of the underlying pathological changes in the biliary system, of which stone is only one result.

We know that millions of bacteria enter the biliary system from the intestinal tract and come in contact with cholesterin, calcium, salts and bile pigments and that most stones are of this combination type. This combination type of stone would lead one to believe that infection is not the sole cause of gallstones, but that lipoid deposits, which are deposits of esters of cholesterin, form in masses of endothelial cells in the tips of villi of the mucosa of the gallbladder. This is a disturbed cholesterin metabolism which gives rise to the so-called strawberry gallbladder. There are, then, three important factors in the formation of gallstones: (1) infection; (2) metabolic disturbances; (3) stasis of bile.

The principal factor in surgical diseases of the biliary tract is without doubt some form of bacterial infection. The exceptions are neoplastic conditions. The main avenues of infection are: (a) direct extension through the common duct; (b) hematogenous, through the portal system and hepatic artery; and (c) through the lymphatic system. The normal bactericidal action of the liver cells is sufficient to overcome and destroy most of the germs carried to them. A lowered resistance of these cells either through disease or overwork may allow some of the organisms to escape destruction and be excreted with the bile. When the detoxifying function is incomplete and the bacteria escape destruction, then the hepatic cells become infected. This is the primary focus or source of infection in most cholecystic inflammation, and it is from this source through

the lymphatic system that the gallbladder wall becomes infected. This at once establishes the possibility of a vicious circle through the lymphatic system from hepatic cells to gallbladder walls, and vice versa. And this formulates the rationale of cholecystectomy, because the vicious circle is broken and a considerable part of the infected tissue removed. This, it seems to me, also accounts for the failure of gallbladder surgery to cure all cases, for bacteria are still carried to the liver and we have no guarantee that the detoxifying function of hepatic cells is any more perfect after cholecystectomy than before. Therein also lies the possibility that, once we have cholecystic disease and possibly after removal by surgery, there is unchecked decomposition of chyme with liberation of skatel, indol, and a number of toxic alkaloids which are not completely detoxified and, therefore, are the underlying causes of biliousness following many gallbladder operations.

With our present knowledge of the liver and its underlying etiological factors in biliary diseases, it does not appear that gallbladder surgical procedures alone will ever result in 100 per cent cures. However, to date, surgery offers the finest results obtainable by all forms of treatment.

After proper diagnosis has been established, the most important consideration is the choosing of the correct operative procedure. It will be remembered from our statistics that cholecystectomy for cholecystitis with stones gave us the most favorable results, the incidence of cures being 83 per cent, and 94.2 per cent of the patients having their general health improved. On the other hand, the patients upon whom a cholecystectomy was performed for cholecystitis with no stone present were cured in only 52.3 per cent, and 81.5 per cent had their general health improved. The average percentage of cures in cholecystectomies in our series then is 67.8 per cent, and the average percentage that had their general health improved but not entirely cured by operation, was 87.8 per cent.

In our series of cholecystostomies, only 52 per cent were cured. The other 48 per cent were not benefited at all by the operation. This shows definitely that cholecystectomy should be the operation of choice wherever feasible, and this is especially true when stones are associated with the cholecystitis. Cholecystectomy is the most desirable procedure although cholecystostomy may at times be an operation of necessity.

There is considerable difference of opinion as to when cholecystectomy is indicated or cholecystostomy advisable. It is my opinion that cholecystectomy can be done in practically all cases if the proper time is selected; in general, it should be done in all chronic cases, all gangrenous cases and in most empyemas of the gallbladder. Conditions under which we should usually limit operation to cholecystostomy are, the acute diffuse infection of the gallbladder involving the ducts sometimes found in exploring an acute abdomen, and also where it is necessary to preserve the gallbladder to divert the flow of bile into stomach or colon.

The difficulties and dangers of removing the acutely inflamed gallbladder when the ducts are involved are too well known to discuss here. Some surgeons still hesitate to remove a gangrenous gallbladder. I do not feel there is any justification for this fear. In gangrene the circulation is shut off and there is practically no danger from this source; and if one fears oozing from the liver surface, the gallbladder may be excised with a radio knife along the hepato-cholecystic margin, thus leaving that part of the gallbladder attached to the liver. By this procedure the major source of the infection can be removed and no raw surface is left to bleed and form adhesions.

The question of drainage in gallbladder surgery is an important one. In general, I will state that drainage should be omitted where the field is aseptic and dry. In all infected cases with active inflammation, drainage should be used. Where the infection involves the biliary ducts, I believe in drainage through the cystic duct and a secondary tube down to the base of the cystic stump. Only very rarely is it necessary to incise the common and hepatic ducts and use a T-tube. I use a T-tube in strictures of the common duct and where large stones are impacted in the duct.

I am going to report a few cases which were unusual and which taught me lessons that have been of value:

Case 1.—Miss F. K. was admitted to Fairview Hospital July 26, 1930, with a definite gallbladder history of four years. Her temperature just before operation was 106°, she was deeply jaundiced, vomiting, and presented a definitely acute abdomen. Procrastination seemed to me out of the question and there was no time to hesitate, for a life was surely at stake. An immediate laparotomy was done and the specimen which I here present was removed. It was an acute gangrenous gallbladder with pus and stones present. After the intestine had been well packed off, the gallbladder fundus was seized with a piece of gauze and a slight traction on it pulled it off from its liver attachment almost to the cystic duct. The balance of the dissection was completed by the fingers. The cystic stump was ligated and a piece of iodoform gauze packed into the liver bed to check oozing from the liver surface. After two stormy days the patient made an uneventful recovery and the jaundice cleared up as quickly as it frequently does with drainage of the cystic duct.

Case 2.—Mrs. M. S. was admitted to the Fairview Hospital December 13, 1932, moderately jaundiced and with an extremely acute abdomen with most tenderness in the right upper quadrant. A laparotomy was done December 14 and an enormously enlarged gallbladder presented itself, together with a marked bulging on the upper surface of the right lobe of the liver. A trocar was inserted into the bulging mass and pus poured out. Here we had a very diffuse inflammation of the gallbladder and ducts with perforation into the right lobe of the liver. A cholecystotomy was done and she made an uneventful recovery. However, about four months later she returned with symptoms of gallstones. A cholecystectomy was done and at this time a stone was found that was evidently overlooked at the first operation.

Case 3.—Mrs. H. M. was admitted to the Fairview Hospital March 16, 1931, with a history of appendectomy the previous year without relief. She had a typical history of gallstones. Cholecystectomy was done for early gangrene of the gallbladder complicated

by a large stone in the cystic duct. On the third postoperative day she began to drain bile, and this continued for some six weeks. She felt well for about eight months, when she began to get attacks of indigestion, became deeply jaundiced, but complained of no particular pain. On January 27, 1932, nine months after her first operation, she was readmitted to the Fairview Hospital complaining of weakness and exhaustion. She was deeply jaundiced but stated she had no pain. A tentative diagnosis of malignancy was made, or probable stone in the common duct. A laparotomy was done on January 29, 1932. Some adhesions were encountered, but were easily liberated. No stones or tumors could be palpated, but there was complete obstruction (due to an atresia) of the common duct at a point where the cystic duct entered it. The stricture was resected and an end-to-end anatomosis was made with a few interrupted sutures, and a T-tube was left in the common duct for eleven months. She made an uneventful recovery.

Case 4.—Mrs. M. S. was admitted to Fairview Hospital December 18, 1933, with a history of three previous cholecystostomies during the past twelve years and external bile fistulæ following all the operations. She had been told by the previous surgeons that cholecystectomy could not be done safely in her case. When she came to us there was an acute exacerbation of her old condition. She was quite deeply jaundiced. Aside from that, her condition was fairly good. A cholecystectomy was done and the cystic duct drained. She made an uneventful recovery and the fistulæ have remained closed.

The chief reason for reporting these cases is to show that hard and fast rules cannot be laid down for gallbladder surgery and that no prolonged preliminary treatment is always necessary for jaundiced cases. In fact, I do not believe that calcium is of any special value in preventing hemorrhage, if there is a hemorrhagic tendency. A transfusion is more efficient and supports the patient much better.

I have arrived at the following conclusions from the study of the cases reported in this paper:

1. Definite disease must be present in the gallbladder before cholecystectomy is advised or performed.
2. After cholecystectomy, all raw surfaces must be carefully covered, preferably with peritoneum.
3. The anesthesia must be administered so that the patient is completely relaxed. In no other way can surgical trauma be eliminated, and efficient work done.
4. Cholecystectomy can be done early even in the presence of jaundice, for delay only extends the involvement and adds to the morbidity and mortality.
5. Cholecystostomy is an operation of necessity at times, but should never be one of choice if cholecystectomy can be done.
6. Cholecystectomy is the operation of choice except in the acutely diffuse cholecystitis with involvement of the biliary ducts or when it is necessary to use the gallbladder as a channel to divert the flow of bile.

Discussion

Dr. Ivar Sivertsen: I wish to congratulate the essayist on his courage, and also on the subject matter that he presents. It is interesting to have him bring to us the records of one institution, and while we cannot be very proud of the fact that this institution had an 8.9 per cent mortality in gallbaldder surgery, we must remember that this includes all surgeons working in the hospital.

There is one thing I should have desired the essayist to have reported: which type of gallbladder surgery showed this mortality, cholecystectomy or cholecystostomy? I believe there are cases of gallbladder disease where it is better to drain than remove the gallbladder. I fully realize that the better surgeons are removing the gallbladder in every case of gallbladder disease with which they come in contact. I understand that Dr. Arnold Schwyzer removes practically 99.9 per cent of his gallbladders, regardless of what condition they are in.

The question of 40 per cent recurrence of symptoms after cholecystectomy seems rather high. I know that in my own work I have not had these patients return, with symptoms, to the extent of 40 per cent, nor do I think that 40 per cent of gallbladder cases have been simply drained. His further statement that 60 per cent of the cases with no stones showed a recurrence of symptoms and that these cases no doubt would have been better off if they had not been operated upon would not agree with my own experience.

In the true gallbladder disease, with stones, that is the acute gallbladder, 83 per cent represents approximately the cure in our cases, and this, too, I think is about the same percentage as we find throughout the country. I do not think we can hope to have a 100 per cent cure in gallbladder disease.

The question of drainage is always interesting. We know there are accessory ducts to the gallbladder, and if these are missed, notwithstanding the fact that we tie the cystic duct and bleeding has been checked, there will be drainage of bile into the peritoneal cavity, and therefore it is always wise to put in a small cigarette drain. I can see no objection to such a drain. It causes no more liability to hernia or infection. I have therefore closed up but one case without a drain, and this I did to my sorrow; I later had to introduce drainage.

Dr. Thorvald Petersen: I cannot give the exact mortality in the two operations. The deaths were greater following cholecystectomy.

In regard to the mortality in the series of cases that I reported, I will state that it compares very favorably with that of other groups reported when cases are not selected but taken at random.

The mortality may be reduced by more careful preoperative preparation. However, no prolonged treatment is needed; often two or three days are sufficient even in serious cases. Glucose, hypodermoclysis and transfusions are the principal agents of value.

In the past two years the mortality in gallbladder surgery has been slightly under 3 per cent and I think that is quite universal in our institution.

So far as drainage is concerned, I think there is an objection to anything foreign in the abdominal cavity, but when the field is aseptic and dry the abdomen may be closed without drainage.

Dr. O. H. Wangensteen (University of Minnesota) made a very interesting report upon the meeting of the

American Surgical Association, which was held June 4, 5, and 6, 1934, at Toronto, Ont., Canada.

REPORT OF THREE CASES OF DIABETIC GANGRENE

Willard C. Peterson, M.D.

In presenting these cases tonight my purpose is not to present anything new or startling but to refresh our memories of what can be done with cases of diabetic gangrene.

All of us know that practically all diabetics have some degree of arteriosclerosis and since the work of Petrain and of Newburgh and Marsh, who first advocated the high fat diets to make up the caloric intake, the incidence of arterial disease has increased.

In a presentation of this type time will not permit going into all the details of the treatment but I should like to mention certain essentials. These can be grouped under two headings.

Prophylaxis.—As soon as a diagnosis of diabetes is made the patient should be warned of the danger of injury to the feet, from bruising, too tight shoes, or nails in the soles or heels of shoes. The paring of calluses is a particular source of danger. The patient should be instructed in the care of the feet as to cleanliness, prevention or treatment of epidermophytosis, the wearing of soft stockings and protection against cold. Of importance also is the warning against excessive standing or walking.

Checking the twenty-four hour urine samples for sugar and keeping the patient sugar-free are factors both in prophylaxis and treatment.

Treatment.—For trophic disturbances we have used warm moist boric packs rather than dry heat because of the danger of too much and uncontrolled heat. Many diabetics have had their ulcers or gangrenous areas aggravated by the application of excessive heat.

Elevation of the foot is important and deviation from this consists of Buerger's exercises ten to fifteen times two to three times daily.

Careful removal of necrotic material does much to hasten healing. No tissue with circulation should ever be cut into, nor should any incision extend beyond the dead areas, as these fresh edges will then become necrotic and the area merely increased in size. Treatment with mild ointments sometimes is useful when the patient becomes tired of the packs but should be used only for a short time.

In the diet as large an amount of carbohydrate as possible has been used and controlled by insulin. We have found that even though these patients have been able to get along on adequate amounts of carbohydrate without the use of insulin, their ulcers heal better if the carbohydrate is increased and the excess controlled by insulin.

Five grains each of theobromine and sodium bicarbonate three times a day have been used in an attempt to increase peripheral circulation.

Presentation of Three Patients

The first patient is a man, fifty-two years of age. His diabetes was first diagnosed about ten years ago. Two years later, or in December, 1926, he developed gangrene of the ends of both big toes. Under diet and insulin and the use of mild packs with elevation, these areas healed with only small amounts of sloughing.

July 20, 1927, he developed an ulcerative condition under the base of the fifth metatarsal bone of the left foot. The urine at this time again showed the presence of sugar. His diet was readjusted and insulin used to clear the sugar. This area continued to drain and on September 22 he developed a deep abscess on the lateral side of the foot. This was treated by warm packs but continued to increase and two days later was incised and drained at the hospital, where he was treated for two weeks more and then sent home for further care.

October 28, 1927, another area of redness and swelling developed on the dorsum of the foot which was treated in the same manner. These areas were all healed by January 4, 1928, five and one-half months after the onset of the most severe symptoms. He continued reasonably well until June 6, 1929, when he again developed a gangrenous area at the base of the small toe and a few days later an area of redness and swelling appeared above it which required incision and drainage. Sugar was again present in the urine. By the end of three months all the areas were healed and have remained so since.

This case represents that of a man actively engaged in business with the constant menace of gangrene whenever he becomes careless in his diet. The temptation of food desire has been extremely great but he apparently realizes the danger now and is more tractable. He is fortunate in having a warning that he is on the danger line in the form of diabetic neuritis which clears up as soon as he is again sugar-free.

The second case is that of a married woman, aged fifty-nine, who was diagnosed as diabetic twelve years ago. On November 14, 1929, she injured the right small toe while trimming a callus. The toe developed pain, tenderness and redness with a watery discharge. On November 21, 1929, she was admitted to the hospital with a gangrenous area extending from the right small toe up onto the dorsum of the foot. The skin was discolored a deep purple and the area was extremely painful.

The entire area was cleansed and warm boric packs applied with the leg in an elevated position. Sugar was present in the urine but with diet and insulin she became sugar-free in approximately four days. On November 24, 1929, there were areas of sloughing tissue. Four days later small sloughs were dissected out, and by December 2 granulation tissue was appearing. However, two days later a gangrenous area appeared on the ball of the right foot. The following day the purple discoloration had spread up to the ankle joint and the entire sole was very painful. After four days, or on December 8, the dorsum of the foot showed improvement but the process in the sole of the foot became more active.

On December 12 and 16 areas of the plantar fascia and the flexor tendon of the right small toe were removed. After this the condition steadily improved and she was allowed to go home on February 2, 1929, with healthy granulating areas on the sole of the foot. These were completely healed two months later.

This case shows what can be done even in massive gangrene without amputation. Her only residuum now is an over-extension of the right fifth toe and slight stiffness and narrowing of the sole of the foot from cicatricial contraction.

The third case is that of a married woman, aged sixty-one, in whom a diagnosis of diabetes was made in 1929. At that time she had pains in her feet and legs

and a diagnosis of arteriosclerosis as well was made. On January 22, 1932, she developed a severe cardiac decompensation following an attack of influenza, from which she recovered after a period of rest in bed.

On September 26, 1932, she developed an infection of the right big toe which in turn developed into a gangrenous ulcer, and did not heal until three months later.

During the summer of 1933 she developed an ulcer of the right heel and decided to go away for treatment. After a stay of six weeks she returned. At this time the ulcer measured 1.5 by 1 inch and was quite deep. The edges were necrotic and no attempt at healing seemed apparent. She was put to bed and the diet adjusted with insulin to make her sugar-free. Warm boric acid packs were applied to the elevated foot and small necrotic bits were removed from the ulcer. Buerger's exercises were used daily.

After about six weeks of treatment small granulating areas were observed on the medial side but the lateral aspect continued to slough and the subcutaneous tissues were undermined. Small areas of necrotic material were removed from time to time. Occasionally Lanolin ointment was used for a few days as a relief from the warm packs and finally on August 7, 1934, the ulcer was completely healed.

This case shows what patience and coöperation of the patient will do for an extremely obstinate type of lesion. No doubt the delay was influenced greatly by the presence of the severe arteriosclerosis.

In conclusion, I feel that I have shown to some degree what can be done for these patients using conservative and simple methods of treatment. Amputations can always be done but if we can give these unfortunates even a moderately impaired foot they are far better able to pursue a normal life than if they had to resort to artificial appliances.

Discussion

DR. IVAR SIVERTSEN: I would just dare suggest a trick I have followed in the treatment of calluses: I simply take a piece of fine sandpaper, and place it on a block of wood and use it as a file, filing down the callus. This will not injure the skin and consequently will prevent any chance of infection or gangrene.

HYPERPARATHYROIDISM

R. C. Webb, M.D.

Summary of Presentation

Hyperparathyroidism is due to a hypertrophy of one or more of the parathyroid glands. Generalized osteitis fibrosa cystica results from this condition and renal calculi may result.

The case report of a patient with this condition was presented together with the parathyroid tumor and x-rays of the skeleton. The patient was a young woman of twenty years with symptoms of three years duration. Her maternal grandfather and her mother may have had hyperparathyroidism. She had had gastrointestinal disturbances, polyuria, polydipsia and general weakness during this period followed by fracture of both femurs January 1, 1934. The neck was explored January 10, 1934, and a parathyroid tumor found and removed. The patient was treated for her fractured femurs and made a good recovery. The areas of bone absorption and destruction elsewhere in her skeleton were shown to be steadily undergoing restoration and repair.

F. A. OLSON, *Secretary.*

REPORTS AND ANNOUNCEMENTS OF SOCIETIES

Medical Broadcast for February

The Minnesota State Medical Association Morning Health Service

The Minnesota State Medical Association broadcasts weekly at 10:30 o'clock every Tuesday morning over Station WCCO, Minneapolis and Saint Paul (810 kilocycles or 370.2 meters).

Speaker: William A. O'Brien, M.D., Associate Professor of Pathology and Preventive Medicine, Medical School, University of Minnesota.

The program for the month will be as follows:

February 5—Some Heart Facts.
February 12—Pernicious Anemia.
February 19—Hives.
February 26—Mouth Health and General Health.

American Congress of Physical Therapy

The American Congress of Physical Therapy announces a one-day session of its Mid-Western Section to be held in the Auditorium of the Service Memorial Institute, Madison, Wisconsin, Tuesday, March 12, 1935.

The morning session will be devoted to hospital clinics and the afternoon session to scientific papers. The evening program will be conducted under the auspices of the section and the Dane County Medical School.

The program may be obtained by writing to Marion G. Smith, Executive Secretary, American Congress of Physical Therapy, 30 North Michigan Avenue, Chicago, Illinois.

College of Surgeons Sectional Meeting

A sectional meeting of the American College of Surgeons, embracing Manitoba, Wisconsin, North Dakota, South Dakota, and Minnesota is to be held in Saint Paul, March 15, 16 and 17, 1935.

On the program will be men of national reputation, some coming from long distances. Clinics will be given in the mornings and scientific papers and movies in the afternoons and evenings. The entire program is open to all members in good standing of county medical societies and all state and provincial districts.

We desire to emphasize especially a welcome to all medical men to attend the program whether they are members of the College or not.

GEORGE EARL, *Chairman,*
Local Arrangements Committee.

Clarence Martin Jackson Lectureship

The second annual address in the Clarence Martin Jackson Lectureship, sponsored by Xi Chapter of Phi Beta Pi Medical Fraternity at the University of Minnesota, will be given by Dr. Logan Clendening, Professor of Clinical Medicine at the University of Kan-

sas. His subject will be "The Human Side of Medicine."

Dr. Clendening is well known for his writings, both technical and popular, on medical subjects, as well as for his ability as a speaker. Some of his better known books are *Methods of Treatment, Behind the Doctor,* and *The Human Body.*

The address last year was given by Dr. Walter L. Bierring, president of the American Medical Association, who spoke on the subject "Historical Sequence of Medical Events."

This year's address will be given in Northrop Memorial Auditorium on the campus of the University of Minnesota at 8:15 P. M., Friday, March 8, 1935.

The general public, as well as the profession, are cordially invited to attend.

Mayo Foundation Lectures

A special program of lectures and demonstrations in medicine will be held under the direction of The Mayo Foundation from March 4 to 8, inclusive. Mornings will be devoted to medical and surgical clinics. In the afternoons and evenings symposiums will be conducted on urology, acute abdominal conditions, pediatrics, gastro-enterology, the thyroid and parathyroid glands, and dermatology. In addition, two clinico-pathologic conferences will be held. On Friday evening, March 8, the Minnesota Trudeau Society will hold an open meeting.

While these programs are arranged primarily for the Fellows of the Foundation, visiting physicians are invited to attend.

Interchange Lectures at Rochester

Lectures by members of the Faculty of the Medical School at the Mayo Foundation, Plummer, Hall, 7:30 P. M.

February 14
*Dr. Henry E. Hartig
Title: "Sound and Hearing"

February 28
Dr. Irvine McQuarrie
Title: "Effects of Certain Salts in the Diet on Blood Pressure and Carbohydrate Metabolism"

March 14
Dr. Morris Nathanson
Title: "Observations Relative to Cardiac Syncope and Sudden Cardiac Death"

March 28
†Dr. John T. Tate
Title: "Transmutation of the Elements"

April 11
Dr. Henry E. Michelson
Title: "Tuberculosis of the Skin"

*Dr. Hartig is Associate Professor of Electrical Engineering.
†Dr. Tate is Director of the University College and Professor of Physics.

Minnesota Radiological Society

The fall meeting of the Minnesota Radiological Society was held at Rochester, Minnesota, October 13, 1934. The program was presented by the staff of the Mayo Clinic and was as follows:

1. Xanthomatosis—Clinical Aspects.....Dr. R. L. J. Kennedy
   Roentgenologic Aspects.....Dr. J. D. Camp
2. Backache .....Dr. R. K. Ghormley
3. Interesting Diagnostic Problems.....Dr. J. D. Coate
4. Mortality Studies on Carcinoma of the Cervix Dr. R. E. Fricke
5. The Duodenal Niche.....Dr. H. A. Burch
6. Osteopoikilosis and Allied Diseases of Bone Dr. C. G. Sutherland
7. Limits of Safety in Roentgenography.....Dr. A. Turnbull
8. The International Congress of Radiology at Zurich and St. Moritz.....Dr. A. U. Desjardins

ADDRESS

Some Effects of Radiation.....Dr. C. Sheard

Leo G. Rigler, M.D., *Secretary.*

Union Hospital Staff Meeting

The staff members of the Union Hospital, New Ulm, met January 8, 1935. The following new officers were installed: Dr. O. J. Seifert, president; Dr. G. Reinecke, vice president; Dr. C. A. Saffert, secretary. Illustrated addresses were given on Abdominal Viscera, Colles' Fractures, and Emergency Operations on Liver and Bladder.

Staff meetings are to be held monthly.

WOMAN'S AUXILIARY

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Editor—Mrs. C. F. Ewing, Wheaton

Ramsey County

The first meeting of the Ramsey County Medical Auxiliary was held at the home of Mrs. Frank E. Burch on Monday, October 29, 1934. Mrs. Nordland, the state president, was there and spoke very pleasantly, but briefly, after the business meeting. The program of the afternoon, arranged by Mrs. J. T. Christison, was an exceedingly pleasing one. Mrs. Adolph Ahrens sang a group of songs, and Mrs. Edgar Russell played a number of violin selections; both were accompanied by Mrs. W. R. Raudenbush. This was followed by a social hour and tea, at which more than ninety members were present.

About seventy members attended the second meeting on November 26, 1934, held at the home of Mrs. F. J. Savage. After a brief business meeting, Mrs. Christison presented Miss Helen Austin, who read the play, "Yellow Jack." It was a most interesting occasion, and the enjoyment continued with the discussion of the play during the tea hour.

It was decided by the Ways and Means Committee, under the chairmanship of Mrs. F. J. Plondke, to hold a series of chain luncheons, starting with eight women, each of whom would contribute fifteen cents to the luncheon she attended and then each would, in turn, invite seven women to luncheon, until all the members had given or attended one. This seemed an easy way to make money, as well as a very pleasant way to make social contacts between the members. There are twenty-seven new members this year.

The Board members were entertained at one of these luncheons, January 21, at the Woman's City Club, with Mrs. C. N. McCloud and Mrs. C. F. Ewing as hostesses. The regular Board meeting followed.

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West Central Minnesota

The West Central Medical Auxiliary met the doctors for dinner at the Merchants' Hotel in Morris, Minn., January 9, at which time they decided to place *Hygeia* in schools and libraries in the district that are without it.

There will be no more meetings until April.

BOOK REVIEWS

Books listed here become the property of the Ramsey and Hennepin County Medical libraries when reviewed. Members, however, are urged to write reviews of any or every recent book which may be of interest to physicians.

PRACTICAL ENDOCRINOLOGY. Symptoms and Treatment. Max A. Goldzieher, M.D. Endocrinologist, Gouverneur Hospital, etc. 326 pages. Illus. Price, cloth, $5.00. New York: D. Appleton-Century Co., Inc., 1935.

SUMMARY OF THE TREATMENT OF FRACTURES AND DISLOCATIONS. R. Broomhead, F.R.C.S. Surgeon, Orthopedic Department, General Infirmary at Leeds, etc. 30 pages. Price, paper cover, 3/6d. Leeds, England: Jowett & Sowry, Ltd., 1934.

OBSERVATIONS OF A GENERAL PRACTITIONER. William N. Macartney, M.D. 478 pages. Boston: Richard G. Badger, The Gorham Press, 1932.

STANDARD CLASSIFIED NOMENCLATURE OF DISEASE. Compiled by National Conference on Nomenclature of Disease. Edited by H. B. Logie, M.D., C.M., Executive Secretary. 870 pages. Price, cloth or flexible binding, $3.50. New York: The Commonwealth Fund, 1935.

ANNUAL REPORT OF THE SURGEON GENERAL OF THE PUBLIC HEALTH SERVICE OF THE UNITED STATES. 142 pages. Price, cloth, 75c. Washington, D. C.: U. S. Government Printing Office, 1934.

PROCEEDINGS OF THE TWENTY-EIGHTH ANNUAL CONVENTION OF THE ASSOCIATION OF LIFE INSURANCE PRESIDENTS. 240 pages. New York: Assn. of Life Insurance Presidents, 1934.

SPINAL ANESTHESIA, TECHNIC AND CLINICAL APPLICATION. George R. Vehrs, M.D. 269 pages. Illus. $5.50. St. Louis: C. V. Mosby Co., 1934.

The rapid increase in the use of spinal anesthesia for subdiaphragmatic surgery is well justified, in Vehrs' experience. In a compact and readable monograph, he covers the subject completely. The anatomy and physiology of the spinal canal and of the cerebrospinal fluid are discussed, and the effect of the addition of soluble anesthetics to the spinal fluid, upon the heart and respiration, are adequately described. The indications and contraindications for, and the complications of, spinal anesthesia are competently discussed. Vehrs states that the mortality rate due to spinal anesthesia is from .007 to .01 per cent, which seems to justify his statement that spinal analgesia is, in proper hands, safer than other types of anesthesia. He confidently believes that total spinal analgesia, under the hands of experienced operators, will prove very valuable in selected cases. Explicit information regarding technic is included.

THOMAS MYERS, M.D.

DR. COLWELL'S DAILY LOG FOR PHYSICIANS. Colwell Publishing Company, Champaign, Illinois, 1934. Price, $6.00.

The volume consists of a day book, an entire page with room for thirty-six entries being devoted to each day of the year. Columns are provided for charge accounts, cash received on account items, and for ledger entry checking.

At the end of each month a page is devoted to a summary of the month's professional business. Two more pages are devoted to the various professional expense items, particularly useful in filling out income tax reports. Further space is provided for a record of non-professional receipts and disbursements, narcotics dispensed, appointments and surgical record.

While most physicians have their own systems of keeping record of these items which seem to suit their particular type of practice, we can recommend Dr. Colwell's Daily Log as one easy method of recording items necessary in present-day practice.

Hospitalization of the Mentally Ill

Members of the House of Delegates and others have been solicited by Dr. John M. Grimes to purchase a book that he has printed purporting to contain the results of the study recently made by the Council on Medical Education and Hospitals of the hospitalization of the mentally ill in the United States. Such individual use of the Council's material is, of course, wholly unauthorized. A report prepared by Dr. Grimes when he was employed by the Association was not published because in the opinion of the Council and an advisory committee of psychiatrists and neurologists his conclusions were not supported by the evidence presented. Two partial reports that have already been published will be supplemented when further studies have been completed.—*Jour. A. M. A.*, Nov. 10, 1934.